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ABSTRACT

In an effort to provide background information and encourage incorporation of ecological understandings into the curriculum, this teacher's guide has been devised for fourth and fifth grade teachers. It utilizes an activity-oriented approach to discovery and inquiry, outlining behavioral objectives, learning activities, teaching suggestions, and bibliographic resources for each unit of study. Fourth grade units cover arthropods, soil, rocks, chemistry, sun, air, water, and the forest. Fifth grade units include pond, marsh, meadow, and forest biomes, pollution, and E-Day activities. This work was prepared under an ESEA Title III contract. (BL)

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ECOLOGY

Elementary Teaching Guide

THE MADISON PUBLIC SCHOOLS

Department of Curriculum Development

Madison, Wisconsin

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SE 014 433

ECOLOGY

Elementary Teaching Guide

Conrad A. Elvehjem Elementary School
Madison, Wisconsin
1969-1970

Fourth Grade	Fifth Grade
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IMC Consultant

Materials financed by a grant
Title II
Elementary and Secondary Education Act

I don't dig
there is so much populat-
ion around here!

SHERYL

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- E Day

SAVE MY PLACE

INTRODUCTION

Elementary school is not too early to introduce ecological principles! The fourth and fifth grade teachers of Conrad A. Elvehjem Elementary School, Madison, Wisconsin, felt that a *concentrated* effort should be made to incorporate some ecological understandings into their curriculum. In June, 1969, they received a $3000 grant under Title II of the Elementary and Secondary Education Act for materials to aid them in this effort. The purposes of the study were ~~was~~ to make background information and experiences available to their students and to stimulate original thinking in the following areas:

1. To help the children become aware of the wealth of natural resources in their own neighborhood, which include a pond, a marsh, and a woods;
2. To make students cognizant of the balance of nature and the need to preserve it;
3. To help the students realize that change is ever present although it is not always easy to perceive;
4. To encourage critical thinking about the serious ecological problems that face the world today;
5. To motivate students to view their interrelationship with the environment with the attitude of "What is my job?" rather than "Why should I be concerned?"

During the summer each teacher who worked on the original grant application participated in at least one activity or in-service course that would help with this study. New teachers were informed of the receipt of the grant early in the summer, and they also began to formulate ideas and do background research. In the fall, as work on the curriculum took form, the teachers decided early to concentrate on the following four concepts:

1. Our natural environment is made up of a diversity of living and non-living things.
2. All things, living and non-living, are interrelated.
3. Change is constant in nature.
4. Living things adapt to their environment.

Later, children also found they could apply these concepts to other subject fields, e.g. social studies.

The teachers chose an activity-centered program, trying to emphasize the approaches of discovery and inquiry. The material obtained through the grant was used to strengthen the informational sources already available and to ensure enough available material so that no child was inhibited in inquiry because of a lack of reference sources. Much use was also made of open-end discussions. The teachers did not try to supply the answer to every question themselves but encouraged the children to assimilate what they had already learned to answer their own questions, to broaden their own background knowledge to answer each other's questions, and to continue bringing up questions for inquiry.

The plans included in this guide by the fourth-grade teachers are a result of team planning; the fifth-grade plans are

are a result of individual teacher planning. They were tried in the class-rooms, subjectively evaluated, and then rewritten, using the following evaluative criteria:

1. The increase in the number of observations demonstrated by the children (the identification of the distinctive features of different animals and plants, the recognition of animal signs, and the identification of plant and animal habitats and the interrelationships that exist);

2. The positive learnings demonstrated by the students in discussions;

3. The end products produced by the children (oral presentations; notebooks and other written materials; and audio-visual aids, such as slides, tapes, and posters);

4. The enthusiasm shown by the students for disseminating the information they had learned.

As the fourth and fifth grade teachers realized the enormity of the task they had undertaken, they generally expressed the view that work in this field could not be started too early in the school curriculum. They believe that the balance of nature and the interrelationships that exist in our environment can and should be consistently emphasized in earlier grades. They also suggest that numerous field trips for the purpose of observation should be a part of every grade's activities.

For a more effective and efficient study, the teachers felt that the following additional things should be considered:

1. In-school planning time. The teachers had only the noon hour for any group planning. They feel that good planning is paramount to a successful educational program and that better teaching results from the pooling of everyone's knowledge, ideas, and talents. Most of the teachers feel that they also need more time for themselves to acquire background knowledge in ecology.

2. Change in personnel. Of the seven teachers who planned this study originally, there has been a change in personnel of four teachers. Because of lack of time these new teachers found themselves hard pressed to acquire the earnestness of those who were in the original group.

3. Ready access to materials. The teachers arrived in the fall enthused and ready to begin work only to find none of the grant material had arrived although all had been ordered. Now, when they must start on the final reports, most of the material is here.

4. Already published project suggestions. The teachers have discovered that some ideas suggested for students simply do not work. They have learned to accept this fact with ease, to discuss the failure objectively, and to proceed with undaunted enthusiasm to the next activity.

Dedication to their students, to the teaching profession, and to the importance of the ecological understandings already mentioned in this introduction have motivated these teachers to continue this work. They feel that the following examples of classroom-related work may help other teachers who are also trying to be pioneers in the study of ecology in the elementary grades. The Elvehjem teachers would welcome any suggestions, ideas, or other experiences from other teachers or from people in the scientific field as they continue to work to improve and expand these beginning efforts.

Iva Helen Gross
Elvehjem IMC Consultant

FOURTH GRADE

ARTHROPODA

BEHAVIORAL OBJECTIVES:

The child can explain in his own words and demonstrate through classroom activities that he understands the following:

1. The characteristics that distinguish arthropoda from other small animals.
2. Man and nature as controlling factors in the life cycle of arthropods.
3. The diversity and adaption among arthropods necessary for survival.
4. The necessity of arthropods to the balance of nature.

ARTHROPODA

I. INTRODUCTION

A. Show slide set, Elvehjem Natural Area, to motivate discussion about the small animals that children have observed during the summer in their neighborhood.

B. Class discussion.

1. Places to look for small animals.
2. Children set up rules on how to handle themselves in the environment where small animals are found.

C. Small animal scavenger hunt.

1. Place: Elvehjem Natural Area (or any natural area close to the school.)
2. Trip activity: Who can list the greatest number of living things belonging to the animal kingdom during the trip? (If the name of the animal is not known, write a short description or draw a picture.) The children may work in small groups or individually, depending upon the class.
3. Follow-up activities.

   (a) Make a composite list of animals observed.
   (b) Winners (children who have observed the most animals) may make a ditto of the composite list for class use.
   Suggestion: Ditto may serve as the first page of a Small Animal Notebook.
   (c) Class discussion of where small animals on the list were seen. Discussion of child behavior suited to environment.
   Were all children careful to preserve environment as they found it?

II. COLLECTING LIVE SPECIMENS FOR STUDY.

A. Discussion of materials needed for and manner of collecting small animals.

1. Containers.
2. Nets with handles.
3. Tweezers.
4. Rules of safety for collecting.

B. Field trip to collect small animal specimens.

1. Work in groups or individually.

C. Observation of small animals collected.

1. Display animals randomly in their containers in different areas of the room. Have small groups of children rotate and observe the animals. As the children observe, they should begin to think of ways of sorting the animals into groups or make lists of possible groups.

D. Class discussion based on lists of groupings.

E. Class activities.

1. Add to the above discussion by using the filmstrips, Processes of Science -- Classifying.

   Part I. Size.
   Part II. Shape.
   Part III. Color.
   Part IV. Ways of Grouping.

2. Read and discuss pages 21-53, "How Are Living Things Put in Groups?" Science Is Experimenting.
3. Group the small animals found in the school natural area into scientific phyla.
   Use an "animal kingdom tree."
4. Choose a group of small animals to study. (Arthropoda are often most available and most numerous.)

   (a) Emphasize interrelationships of arthropods to other animal groups.
   (b) Emphasize why arthropods are so numerous.

III. OBSERVATION AND STUDY OF ARTHROPODA. (Study could be limited to insects, if so desired.)

A. Observation of body to determine likenesses and differences.

B. Observation of legs to determine likenesses and differences.

C. Observation of head to determine likenesses and differences.

1. Antennae. (If animal doesn't have a pair of antennae, it is not a true insect.)
2. Mouth parts.
3. Eyes.

D. Observation of wings to determine likenesses and differences.

E. Discussion of observations stressing likenesses and differences.

1. Likenesses.

   (a) Three body parts.
   (b) Pair of antennae.
   (c) Six legs.

2. Differences.
3. Classify according to animal kingdom tree.

   (a) Insects.
   (b) Myriapods.
   (c) Arachnids.

SUGGESTIONS FOR OBSERVING AND STUDYING ARTHROPODA

I. OBSERVATIONS OF THE BODY

Directions:

1. Use a magnifying glass to observe the arthropod you have chosen to study.
2. Make a drawing of the body of this animal.
3. Take notes during your observations to answer the questions listed under "Observation Helps".
4. Be prepared to discuss your answers in class.

A. Draw the body of your arthropod.

B. Observation Helps:

DIVERSITY — 1. What color or colors does the outer body of your arthropod have?

ADAPTION
INTERRELATIONSHIPS — Why do you think your arthropod is colored the way he is? (Hints: Where did you find him? For whom would he make a good meal?)

DIVERSITY

2. Very gently press the outside of the arthropod's body. Compared to the hardness or softness of the outside of the body of a kitten, a puppy, or some other mammal you have touched, would you say the outside of the body of the arthropod is soft or firm?

DIVERSITY

Very gently press a spot on the outer part of your own body. Compared to the hardness or softness of the outside of your body, would you say the outside of the body of the arthropod is soft or firm.

ADAPTION

What reasons can you see for the kind of body covering your arthropod has? (Hints: Does your arthropod have a bony skeleton like you? Is an arthropod very big compared to many animals?)

3. How many parts does the body of your arthropod have?

ADAPTION
DIVERSITY

As you study your arthropod, see if you can think of a function for each body part.

DESCRIPTION OF BODY PART	FUNCTION
a.	a.
b.	b.
c.	c.
d.	d.

ADAPTION 4. Are there pockets or hair on the outer body parts of your arthropod?

If so, where are they?

What functions might the pockets or hair serve? (Hint: Does your arthropod have hands like you do?)

ADAPTION 5. Can you find a row of holes or punctured rings on the side of the body of your arthropod?

What function might the little holes or punctured rings serve? (Hint: Does your arthropod have lungs and nostrils like you?)

CHANGE 6. As you observed and studied the body of your arthropod, did you notice anything that might suggest that the animal might not always have looked this way, or that it might not always look this same way in the future?

If so, list the things you observed that suggested a change had taken place or that a change might take place in the future in the appearance of the arthropod. (Hint: Have you always looked the same as you do now, and will you always look the same in the future?)

II. OBSERVATIONS OF THE LEGS

Directions:

1. Use a magnifying glass to observe the arthropod you have chosen to study.
2. Make a drawing of the legs of this animal.
3. Take notes during your observations to answer the questions listed under "Observation Helps".
4. Be prepared to discuss your answers in class.

A. Draw the legs of your arthropod.

B. Observation Helps:

ADAPTION DIVERSITY	1. How many legs does your arthropod have?
ADAPTION DIVERSITY	2. To what parts of the arthropod's body are the legs attached?
ADAPTION and possibly	3. Are there any pockets or hair on your arthropod's legs?
INTERRELATIONSHIPS	If so, what purposes might they serve?

ADAPTION 4. How are your arthropod's legs formed? (Hint: Do you see any joints?)

Why would jointed legs be suited to an arthropod's life?

ADAPTION 5. Do you see any differences between the front legs and the hind legs? If so, describe the differences.

Do the differences you see make sense for the use your arthropod might make of his legs?

SHAPE	USE
FRONT LEGS	
HIND LEGS	

ADAPTION 6. Observe your arthropod move. Does it jump, leap, walk, other? Describe the movement.

ADAPTION 7. Observe your insect feed. Does it use its legs during feeding? If so, how does it use them?

ADAPTION

8. Place your insect on some loosely packed soil. Does it use its legs to dig or burrow into the soil?

If it does, for what reasons might it do this?

ADAPTION

9. Place a container filled with water down into the soil. Does your arthropod go near to or into the water?

If it goes into the water, does it swim?

If it swims, describe how it uses its legs for this activity.

c. For what reasons might your arthropod have gone into the water?

ADAPTION

10. Place your arthropod on a small branch or stick. Does it use its legs to hold itself onto the branch or stick?

If so, describe how it does this.

ADAPTION
DIVERSITY

11. List as many ways as you can think of that explain why your arthropod's legs are important to him.

CHANGE

12. As you observed and studied the legs of your arthropod, did you notice anything that might suggest that the animal's legs have not always looked this way or that they might not always look this way in the future?

If so, list the things you observed that suggested a change had taken place or that a change might take place in the future in the appearance of this arthropod.

III. OBSERVATIONS OF THE HEAD

Directions:

1. Use a magnifying glass to observe the arthropod you have chosen to study.
2. Make a drawing of the head of this animal.
3. Take notes during your observations to answer the questions listed under "Observation Helps".
4. Be prepared to discuss your answers in class.

A. Draw the head of your arthropod.

1. Draw the antennae.

2. Draw the mouth part.

3. Draw the eyes.

B. Observation Helps:

ADAPTION

1. Does your arthropod have any feelers or antennae?

If so, how many pairs of antennae does he have?

What do you think the functions of your arthropod's antennae might be? (Hint: Does your arthropod have ears and a nose like you?)

ADAPTION
DIVERSITY

2. If possible, observe your arthropod as it is feeding. Does the feeding part or mouth part of the animal appear to be a chewing mouth part or a sucking mouth part?

ADAPTION

Why is the kind of mouth part your arthropod has a good one for him? (Hint: What does your arthropod eat?)

ADAPTION
INTERRELATIONSHIPS

Try feeding your arthropod several kinds of food that you think it might be able to eat with its kind of mouth part. Try some of the following:

1. plants
2. animal remains
3. waste materials
4. other animals

Were you successful? If so, list the foods your arthropod ate.

List the foods your arthropod did not eat.

List as many reasons as you can think of that might explain why you arthropod did not eat the foods listed above.

INTERRELATIONSHIPS

Considering the kinds of food this animal eats, would you say it is helpful, harmful or both of these things to man? Explain your answer.

ADAPTATION DIVERSITY

3. How many eyes can you find on your arthropod?

Are the eyes all the same size?

Why do you think your arthropod has more than one kind of eye?

Test your arthropod to see if it can see in the following directions without turning its head. (Use a flashlight from different distances and angles. Bring some object near the insect from different distances and angles.)

OBJECT USED FOR TESTING	DISTANCE FROM ARTHROPOD	ANGLE: AHEAD, BEHIND, ABOVE, BELOW, FROM EACH SIDE	REACTION

List as many ways as you can think of that explain how your arthropod's eyes might be useful to him.

V. SUMMARY

1. How are arthropoda alike?

2. How do arthropoda differ?

3. How would you put the arthropoda we have been studying into classes?

4. How are insects alike?

5. How do insects differ?

6. How is the arthropod you are studying adapted or suited to his place of living?

7. Where does your arthropod fit into the food chain?

8. How are the lives of arthropoda and the lives of man related?

9. What would happen if the entire species of the arthropod you are studying was completely wiped from the face of the earth?

10. What would happen if the entire arthropoda phyla was completely wiped from the face of the earth?

11. Man often changes the natural environment around him. Are these changes man makes ever justified? Always justified? Never justified? Why?

12. Does man ever change nature without fully realizing what these changes might mean? Should he do this? Why or why not?

13. Why is it important to understand how any living thing fits into the balance of nature before action is taken to rid the environment of this living thing?

14. Would you guess that changes in non-living things in our environment might also affect the balance of nature? Why or why not?

IV. OBSERVATIONS OF THE WINGS

Directions:

1. Use a magnifying glass to observe the arthropod you have chosen to study.
2. Make a drawing of the wings of this animal.
3. Take notes during your observations to answer the questions listed under "Observation Helps".
4. Be prepared to discuss your answers in class.

A. Draw the wings of your arthropod.

B. Observation Helps:

ADAPTION
DIVERSITY
1. How many pairs of wings does your arthropod have?

2. To what part of the body of your arthropod are the wings attached?

ADAPTION
DIVERSITY
INTERRELATIONSHIPS
3. What color or colors are the wings?

ADAPTION
INTERRELATIONSHIPS
4. Describe any sound the animal makes with its wings.

5. List as many ways as you can think of that tell how your arthropod's wings might be of benefit to him.

ON-GOING ACTIVITIES

I. Individual Reports

As children study arthropods, they pose many questions which are not always answered through their observations or class discussions. One or two brainstorming sessions during which the children pose these questions will provide the material with which the teacher can structure an outline for further study. The children can then use their own questions as a guide for individual research and reporting.
(See attached Sheets)

II. Winter Insect Hunt

A winter insect hunt will allow students to observe some ways in which animals are adapted to survive seasonal changes. Plant galls, nests of mud-daubauber wasps, cocoons, and chrysalises can be brought to the classroom and kept in emergence cages. Most of the pupae will continue to develop in heated rooms and will change into adults within a few weeks.

III. Longevity Charts

The life spans of insects can be put into chart form. Discussions can center on the comparisons of the life spans and on the reasons for the lengths of the life spans.

THE STUDY OF ARTHROPODS

In science, natural history deals with all living things. These living things are divided into the plant kingdom and the animal kingdom.

The whole group of the world's known animals may be divided into 16 phyla or groups. One of these groups includes all animals having segmented bodies and jointed appendages (legs, antenna, etc.) They are known as Arthropods and include such animals as crawfish, lobster, crabs, centipedes, millipedes, spiders and insects. (Insects differ from these others in having just six legs.)

From this group of Arthropods you have chosen to study insects and spiders. The questions you want to find answers to about these small animals have been grouped into 4 sections plus 1 extra credit section for easier studying. You will study one section at a time. The activities you are asked to do in each section will help you to answer your questions. Answer only the questions that have to do with the animal you are studying. You do NOT have to answer all of the questions.

DIRECTIONS: Take notes (words and phrases) to answer the questions in each section. Then use your notes to write complete sentences. You should end up with one or more paragraphs in each section. Each section will take up one or two pages in your finished notebook.

When you finish one section, give it to your teacher to check. When it is done well enough to be put into your notebook, you may go on to the next section.

SECTION I

What is the name of the Arthropod you are studying?
What does the name mean?
What family or group does this small animal belong to?

End of section I

SECTION II

DIRECTIONS:

Make a pencil drawing of your arthropod.
If your small animal has the following body parts and appendage parts, label them on your drawing.

head
antenna
eyes
thorax
legs
wings
spiracles
abdomen

DIRECTIONS:

When you have finished your drawing and have labeled the parts, look for answers to the following questions. Take notes (words and phrases) to answer these questions. When you have all of the information you need, put it into paragraph form. The answers to each set of questions will make up one paragraph. Use complete sentences. Answer ONLY the questions that have to do with the small animal you are studying. You do NOT have to answer all of the questions.

How many body parts does your arthropod have? Why?
Why is the outside of the main body parts hard?
Does this small animal have inside bones?
Does it have blood and a heart?
What color or colors is it?
Why might it be colored this way?

How many eyes does your arthropod have? Describe them.
How are they used?
Can this small animal "see" with any other of its parts?

Does your arthropod have antennae?
Is so, what are these antennae used for?
How does your arthropod hear?
Does it make any sound or noise? If so, what does it sound like?
Why might it make this sound?
How does it communicate?
How does it sense danger?

Does your arthropod have spiracles on its body? If so, where are they found?
What are they used for?

What kind of mouth does your arthropod have?
How does it drink?
Does it prepare its food in a special way? If so, how?

SECTION II continued:

Can your arthropod walk on walls and ceilings? Why or why not?
Can it walk on spider webs? Why or why not?
Does it use its legs in a special way? If so, how?

Does your arthropod spin a web or a cocoon? If so, where does it get the thread it spins with?

Does your arthropod have wings? If so, how does it use them? What do they look like?

End of Section II

SECTION III

DIRECTIONS:

Use one of the charts below to make a drawing of your arthropod in each of its states of development.

INCOMPLETE METAMORPHOSIS

EGG	NYMPH	ADULT

COMPLETE METAMORPHOSIS

EGG	LARVA	PUPA	ADULT

SECTION III continued.

DIRECTIONS:

When you have finished your chart, look for the answers to the following questions. Take notes (words and phrases) to answer the questions. When you have all of the information you need, put it into paragraph form. Use complete sentences. Answer ONLY the questions that have to do with the small animal you are studying. You do NOT have to answer all of the questions.

How many stages of development does your arthropod go through?
What are the stages?
If it molts, how many times does it do this?
What does it look like when it is born?
Does it produce eggs?
If so, how many eggs does it lay in a lifetime?
What happens to it after it lays its eggs?
Is it ever in the form of a caterpillar? If so, how many body parts does it have then? How many true legs does it have?
How many false legs does it have?
If it spins a web or a cocoon, when does it produce the material to do this with?
What happens to it when it is resting in its pupa stage?

End of Section III

SECTION IV

DIRECTIONS:

On construction paper use string or yarn to construct a web. (See sample web.) Draw a small picture of your arthropod and place it on the web. As you answer the following questions, make other small drawings of plants or animals and place them on the web where they belong. When your "web of life" is finished, it will be one of the most interesting parts of your notebook.

What is the size of your arthropod?
What does it eat?
What eats it?
What eats the animal or animals that eat it?
Do any plants use it for food?
If so, how do they do this?
How long might it live if it is not eaten by other animals
or killed in some other way?
What happens to it when it dies?
How does it fit into the food chain?
Is it useful to plants in other ways? If so, how?

What is the place like that your arthropod lives in or around?
Does it live in a wet or a dry place? Other?
Does it live in a hot or cold place? Other?
Does it like a lot of sun or does it like shade? Other?

How is the life of your arthropod related to man?
Is it helpful to man? If so, in what ways is it helpful? (Remember
the food chain.)
Is it harmful to man? If so, how is it harmful?

Does man have to help nature to control the number of the arthropods?
If so, what does man do to control them?
If so, is this a good way to control them? If so, why? If not, why?
What might happen to other animals and to man if all of these arthropods
would disappear?

End of Section IV

SECTION V

EXTRA CREDIT REPORTS

DIRECTIONS:

Choose one of the following subjects and write a report on it. Or, choose a subject of your own that is about arthropods and how they live, and write a report on it.

How arthropods or insects protect themselves.

How insects travel or migrate from one place to another.

How insects are classified or divided into groups.

The history of insects.

How insects communicate.

How high and how far grasshoppers can jump. (See your teacher about this one.)

End of section V

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FILMS

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Silkworm Moth

By Kathy Barlow

The name of the arthropod I am studying is the Silkworm Moth. The Silkworm Moth is called the Silkworm Moth because it gives us silk. My arthropod belongs to the Bombycidae family.

The Silkworm Moth has 3 body parts. It does not have inside bones. It does have blood and a heart. It is brown, black, pink, yellow, white and orange. It is colored this way for camouflage.

The Silkworm Moth has 2 eyes. They are small and black. It uses them to see with. The Silkworm Moth cannot see with any other part of its body.

It does have antennae. The Silkworm Moth uses them to communicate with. It hears with its antennae too. It communicates with its antennae and senses danger with them too.

The Silkworm Moth has a small mouth used for chewing. And it drinks with his mouth. It does not prepare its food in a special way.

The Silkworm spins a cocoon. it gets the threads from tiny holes near its mouth.

It does have wings. It can't use them for protection because it cannot fly. They are a brownish color.

My Silkworm Moth goes through four stages. The stages are first the egg, then the larva, the pupa then the adult. The Silkworm molts 4 times. When it is born it look like a small worm. The Silkworm Moth produces eggs. It lays about 300-500 eggs in a lifetime. After it lays its eggs it dies.

The Silkworm Moth which is my arthropod eats mulberry leaves. Caterpillars eat mulberry leaves and birds eat caterpillars. No plants use it for food.
The Silkworm Moth might live a season if it was not eaten by any animal or killed in any way. When the Silkworm Moth dies it decays into the ground or something eats it. The Silkworm Moth fits into the food chain like this: We start with the Silkworm Moth, and the Silkworm Moth eats mulberry leaves and mulberry leaves

uses soil for food. Soil uses foxes for food because when they die they decay. Foxes eat birds and birds eat snakes. Snakes eat frogs and now we are back to the Silkworm Moth because frogs eat Silkworm Moths. The Silkworm Moth does not help plants in any way.

The Silkworm Moth lives in many different places. Some places are in China, in the woods, sometimes you may find them in mulberry bushes. The Silkworm Moth likes shade.

The life of the Silkworm Moth is related to man because it gives man silk. The Silkworm Moth is helpful to man because it gives man silk for clothing. The Silkworm Moth is not harmful to man.

Man does have to control the number of anthropods. Man uses a kind of spray to control them, but I do not know the name of it. Yes, I think this is a good way to control and, also, no I don't. Yes, because it keeps us from getting too many and no because it may kill too many, and some are helpful to man. Animals may die, if we killed all the insects or they all died or got eaten because animals use arthropods for food. And man would die if animals died because people use animals for food.

How Insects Communicate

The way insects communicate is very interesting. They communicate with their antennae. They can hear and smell and talk with their antennae. Some insects, but very few do not have antennae. Insects can also feel with his antennae. Antennae have different shapes, like moths have some like feathers and butterflies have little knobs at the tip. With the antennae the insect is able to test the surrounding's objects. The antennae help them communicate with other insects. The insects communicate by moving their antennae in different ways. Most insects without antennae are helpless. This is how insects communicate and use its antennae.

SOIL

BEHAVIORAL OBJECTIVES:

The child will be able to explain in his own words and demonstrate through classroom activites that he understands the following:

1. There is a great diversity in the composition of soils that make up the earth.

2. Living things are interrelated with soil.

3. It may take hundreds or thousands of years to develop mature soils.

4. Man's misuse and overuse of soil has resulted in changes taking place on our earth that threatens to destroy it as a place to live.

5. Man must learn to conserve his forests, grasslands, animals, and water supplies if he is to conserve his soil and thus perpetuate life on earth as we know it.

SOIL

SECTION I

INSECTS AND THEIR RELATIONSHIPS TO THE SOIL

In our study of arthropods, we discovered many reasons why they deserve our protection. For example, we discovered that insects act as pollinators, manufactures, sources of food, predators, parasites, scavengers, and soil conditioners. It is to the role of insects as contributors to the development and conservation of soil that we now direct our study.

ASSIGNMENT:

1. Choose one of the following three areas for research and study. Be prepared to report your finds to the class.

2. Take notes on the information given to you by your classmates. This information will provide you with material with which you can begin a "picture" notebook on soil. Section I of your notebook will concern "Insects and Their Relationships to the Soil".

3. Draw a picture or a series of pictures for your notebook that show the things you have learned about insects and their relationships to the soil.

4. Write a paragraph or short report to explain what your picture is about. Include this in your notebook.

Area I

1. What is a legume?
2. Why are legumes such as clover and vetch important to the conservation of soil?
3. How do legumes enrich the soil?
4. Without insects to pollinate legumes, what would happen to them?

Area II

1. Of what value are ants, grubs, beetles and crickets to our soil?

Area III

1. What are the roles of scarab beetles (India), burying bettles, carrion bettles, and blow-fly maggots in nature?

2. What are the roles of borers and termites in nature?

#

SOIL

SECTION II

HOW SOIL IS FORMED

ASSIGNMENT:

1. Take notes to answer the following questions. This information will provide you with material for Section II of your notebook.
2. Draw a picture of a series of pictures for your notebook that show what you have learned about the ways soil is formed. (Because we will study animals and plants in greater detail in Sections III and IV, emphasize the relationships of natural forces to soil formation in this series of pictures.)
3. Write a paragraph or short report to explain what your picture is about. Include this in your notebook.

QUESTIIONS:

1. List three basic needs that soil provides us with.
2. What is the basic ingredient for all soil?
3. What two things does rock contribute to soil?
4. How long does it take nature to change rock to soil?
5. List 7 ways in which natural forces act to break up rock?
6. When does soil formation actually begin?
7. List two ways plants aid in the development of soil.
8. How do animals contribute to soil formation?
9. List the three layers of soil and the type of matter found chiefly in each layer.

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SOIL

SECTION III

ANIMALS AND THEIR RELATIONSHIPS TO THE SOIL

ASSIGNMENT:

1. Take notes to answer the following questions. This information will provide you with material for Section III of your notebook.
2. Draw a picture or a series of pictures for your notebook that show what you have learned about animals and their relationships to soil.
3. Write a paragraph or a short report to explain what your picture is about. Include this in your notebook.

QUESTIONS:

1. How are domestic animals helpful in soil-building processes?
2. What do animals get from the soil?
3. How do animals illustrate man's dependence on the soil for food?
4. How are earthworms helpful in keeping soil in good working condition?
5. How are earthworms helpful in soil-building processes?
6. In what two ways are insect colonies helpful to soil?
7. What relationships do birds have to soil?
8. How do beavers help in the development of new soils?
9. How do beavers help to stop erosion of soil?
10. What role does "animal management" play in the conservation of our soil?
11. In what way is animal management and soil conservation related?
12. What do we mean when we say that "all living things are interdependent?"
13. What do we mean when we say that "living things and non-living things are interrelated?"

#

SECTION IV

PLANTS AND THEIR RELATIONSHIPS TO THE SOIL

ASSIGNMENT:

1. Take notes to answer the following questions. This information will provide you with material for Section IV of your notebook.
2. Draw a picture or a series of pictures for your notebook that show what you have learned about plants and their relationships to the soil.
3. Write a paragraph or a short report to explain what your picture is about. Include this in your notebook.

QUESTIONS:

1. What is humus?
2. How is humus formed?
3. How does humus help to form soil?
4. What elements does humus supply to the soil?
5. In what other ways does humus help soil?
6. What are lichens?
7. What is their role in the formation of soil?
8. How do plant roots help to form soil?
9. In what other ways do roots help soil?
10. What are legumes?
11. How do legumes help the soil in which they grow?
12. How do plants help to protect soil from damage by natural forces of weather?

#

SOIL

SECTION V

HOW MAN HAS USED THE SOIL

ASSIGNMENT:

1. Take notes to answer the following questions. This information will provide you with material for Section V of your notebook.

2. Draw a picture or a series of pictures for your notebook that show what you have learned about man and how he has used the soil.

3. Write a paragraph or a short report to explain what your picture is about. Include this in your notebook.

QUESTIONS:

1. For what reasons did the early colonists develop a careless attitude in the ways they used the land?

2. What are some evidences of the harmful results of our past uses of our lands?

3. What are some of the reasons for the destruction of our land?

4. What are some of the things man has done which have made great destruction possible?

5. Why must we now change our ideas about land uses and management?

6. What common habits in our way of life tend to promote wasteful use of land?

7. What relationships do you see between land and the standard of living?

8. Compose a list of 10 land use "commandments."

#

SOIL

SECTION VI

HOW LONG WILL IT LAST?

ASSIGNMENT:

1. Take notes to answer the following questions. This information will provide you with material for Section VI of your notebook.

2. Draw a picture or a series of pictures for your notebook that show what you have learned about our soil problem and the things that man must do to solve this problem.

3. Write a paragraph or a short report to explain what your picture is about. Include this in your notebook.

QUESTIONS:

1. How long does it take to develop mature soil?

2. About how much of the earth's land surface is suitable for raising crops?

3. About how much of the land surface in the United States is suitable for raising crops?

4. How many acres of productive soil per person are needed to maintain an adequate standard of living?

5. List 8 things man must do to solve the soil problem.

#

SOIL

SECTION VII

HOW MAN CONSERVES THE SOIL

ASSIGNMENT:

1. Take notes to answer the following questions. This information will provide you with material for Section VII of your notebook.

2. Draw a picture or a series of pictures for your notebook that show what you have learned about how man conserves the soil. Or, construct a "chain of life" in which the links are animals, minerals, water plants, soil, and conservation. For each link in the chain, prepare a list of positive and a list of negative practices.

3. Write a paragraph or a short report to explain what your picture is about. Include this in your notebook.

QUESTIONS:

1. Why must we also conserve our forests, grasslands, animals and water supplies if we are to conserve our soils?

2. What is the purpose of each of the following in the conservation of soil?

   a. Fertilizing
   b. Use of crop residue
   c. Green-manuring
   d. Pasturing
   e. Crop rotation
   f. Cover crops
   g. Cultivation
   h. Contour farming
   i. Grass waterways
   j. Strip cropping
   k. Terracing
   l. Mulching
   m. Forested slopes
   n. Farm woodlots
   o. Windbreaks
   p. Gully reclamation
   q. Irrigation

3. What should be the role of the city dweller in conservation problems?

4. What should be the role of the farmer in conservation problems?

5. What should be the responsibility of human beings in general with regard to nature's chain of life?

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SOIL

SECTION VIII

FACTORS IN THE EVOLUTION OF LANDSCAPES

ASSIGNMENT:

1. Take notes to answer the following questions. This information will provide you with material for Section VIII of your notebook.
2. Draw a picture or a series of pictures for your notebook that show what you have learned about the forces of nature that are involved in changing our landscapes.
3. Write a paragraph or a short report to explain what your picture is about. Include this in your notebook.

QUESTIONS:

1. Forces which tend to wear away landforms are often termed "destructive" forces? Why are the following forces often considered destructive forces?
    a. Ground water and running water
    b. Glaciers
    C. Wind
    D. Gravity
    E. Weathering which includes: expansion and contraction, wedging of plant roots, action of freezing water, and chemical activity.
2. Why are the following processes considered constructive processes?
    a. Volcanism
    b. Diastrophism
3. Why can the wind be considered as a constructive force as well as a destructive force?
4. Can any of the other forces listed above also be considered constructive forces? If so, why?
5. Why is gravity an important factor in the evolution of landscapes?
6. List the evidence of constructive forces you have observed in your neighborhood.
7. List the evidence of destructive forces you have observed in your neighborhood.

#

SOIL

ON-GOING ACTIVITIES

1. Learn how to use soil maps which are available from the United States Department of Agriculture and the State Agricultural Experiment Stations.

2. Examine different plant communities in your area. Note the types of soil in which they grow. What differences do you see?

3. Find out about the different types of soil, how they are formed, and the uses for which they are best fitted.

4. Make a report on the history of land use and deterioration in the United States.

5. Make a report on the history of conservation in the United States.

6. Construct a wall-sized chain of life in which the links are animals, minerals, water plants, soil, and conservation. For each link in the chain prepare a list of positive and a list of negative practices.

#

SOIL

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Plant Life and The Soil, Encyclopedia Britannica Films, Inc.

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Our Soil Resource, 3M.

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ROCKS

OBJECTIVES

The child will be able to explain in his own words and demonstrate through classroom activities that he understands the following:

1. There is great diversity among the rocks and minerals which make up the earth.
2. There is an interrelationship among rocks, minerals, and living things.
3. Change in rock formation, along with factors which promote it, are important.
4. Man has learned to adapt rocks and minerals to his needs and he must use them wisely.

ROCKS

I. Discussion

A. Rocks are composed of the same minerals which make up soil. Think back to the things you learned when we studied our unit on Soil. List the ways in which a rock can become soil.

Do you think soil could ever become a rock? Explain.

B. Do rocks differ? Do you think rocks change? Give reasons for your thinking. How can we find answers to these and other questions about rocks. Write down the things you think and then set up an hypothesis.

HYPOTHESIS:

II. Bring a rock to school.

A. Look at your rock. Describe it. Use your imagination. Write a paragraph or a story about your rock. (Maybe you would prefer to write a poem.)

B. Do you think a scientist would describe your rock in the same way that you described it? Why or why not?

C. Read in books on rocks. See if you can find out how scientists look at rocks. List some of the things they look for.

D. Observe your rock using some of the standards that a scientist would use.

1. HOW DOES YOUR ROCK LOOK?

(a) (Check one.) Generally, my rock seems to be

smooth and rounded off. ____________
jagged. ____________

(b) (Check all that apply.) Under a magnifying glass my rock seems to be

layered. ____________ solid. ____________
massive. ____________ porous. ____________

(c) (Check one.) Under a magnifying glass I find that my rock

is sparking and probably has a crystalline structure. ____________
is full of grains and probably has a granular structure. ____________
Seems to have no crystals or grains, so probably has a compact structure. ____________

(d) (Check one.) When I hold my rock up to the light

no light passes through, so my rock is probably metallic. ____________
some light passes through the edges, so my rock is probably non-metallic. ____________

(e) IF YOUR ROCK IS NON-MENTALLIC, describe its color or colors.

(f) IF YOUR ROCK IS METALLIC, make a streak with it on a piece of tile. The color of the streak will be the color of your rock. What color is your rock?

2. HOW DOES YOUR ROCK SMELL?

Smell your rock. If it has an odor, tell what it smells like.

3. HOW DOES YOUR ROCK FEEL?

(Check all that apply.) My rock feels

smooth. ____________
sandy. ____________
slippery. ____________
other ____________ Describe ____________

4. HOW HARD IS YOUR ROCK?

(a) Use your fingernail to scratch your rock. If your fingernail leaves a mark, your rock is a very soft rock. (Check below.)

Very soft rock ____________

(b) Use the edge of a penny to scratch your rock. If the penny leaves a mark, your rock is a soft rock. (Check below.)

Soft rock ____________

(c) Use a knife to scratch your rock. If the knife leaves a mark on your rock, it is a medioum rock. (Check below.)

Medium rock ____________

(d) If your rock cannot be scratched by a knife, try to scratch a piece of glass with your rock. If your rock scratches glass, it is a hard rock. (Check below.)

Hard rock ____________

(e) Try to scratch the knife with your rock. If your rock scratches the piece of glass and the knife easily, it is a very hard rock. (Check below.)

Very hard rock ____________

5. HOW DOES YOUR ROCK REACT TO A CHEMICAL TEST?

Observe your rock by using a chemical test. Scratch your rock with a knife and apply vinegar to the spot. If your rock fizzes, it is probably calcite, limestone, or marble.

Did your rock fizz? ____________

6. IS YOUR ROCK MAGNETIC?

Some rocks respond to a magnet. Hold a magnet near your rock. If your rock is drawn to the magnet, you may have some black magnetite. (Check one.)

My rock was drawn toward a magnet. __________
My rock did not respond to a magnet. ____________

III. What makes up your rock?

Look in books under ROCKS and MINERALS. Read pages 95-98 in Today's Basic Science.

A. Define a mineral.

B. How many minerals are there?

C. How can we tell one mineral from another?

D. Look for the minerals in your rock with a magnifying glass. Can you see a crystal?

If you see a crystal, draw it.

E. See if you can find out what the softest and the hardest minerals are.

Sofest mineral ______________________________

Hardest mineral ______________________________

F. Do the following experiment.

You will need:

Water
Jar
Spoon
String
Measuring cup
Hot plate
Coffee can
Small stick
Rock salt (about 2 cupsful)

Boil a cup of water in a coffee can. Put 4 teaspoonsful of rock salt into the water. Stir the salt until it dissolves. Keeping adding salt until no more will dissolve. When the salt solution is cool, pour it into a jar. Hang a knotted string in the jar. Hang it from a stick lying across the top of the jar. Let it stand for a week or more.

What happened at the end of a week?

What does this tell us about the formation or rocks?

Do minerals really grow? Explain.

Of what importance is the rate at which crystals cool to rock formation?

G. Below are some common rock-forming minerals. See if you can find out which rocks they help to form.

MINERALS	ROCKS
Quartz	
Feldspar	
Mica	
Hornblende	
Calcite	

NOTE: By now you realize that most rocks contain more than one mineral.

IV. Rocks are very interesting and it is important that we know something about them. They help us understand the earth and its history.

A. Many scientists spend their lives studying about the earth and its rocks and minerals. If you grow up to be a scientist you might choose one of the following areas for your work. Find out what you would study or work with in each area.

1. Geology

2. Petrology

3. Mineralogy

4. Paleontology

V. How are rocks located within the earth?

   A. Look in books and find out what and where the following are.

      1. Mantle rock.

      2. Bedrock

Rocks-10

B. Draw a picture showing the composition of the earth. Use these words to label parts of your picture.

inner core
outer core
mantle
crust

iron and nickel
hot, liquid iron
solid rock

C. Deep forces are at work within the earth all of the time. These forces cause damage inside the earth and on the earth's surface.

Review the following questions and you will have a better understanding of how the earth and rocks are related.

1. What is diastrophism?

2. What causes an earthquake?

3. Why do we have volcanoes?

4. How are mountains made?

VI. Geologists classify rocks into three big classes. Write a report about each of the following classes of rocks.

A. Igneous rocks.

B. Sedimentary rocks. (Be sure to mention conglomerates in your report.)

C. Metamorphic rocks.

VII. How can rocks be changed?

A. Rocks can change their form. When this happens, they "move' from one class to another. Igneous and sedimentary rocks can change into metamorphic rocks. Metamorphic is a Greek word which means "change of form." (Remember how insects went through metamorphosis?)

Below are some changes which take place among rocks.

IGNEOUS	SEDIMENTARY	METAMORPHIC
Granite	----------	Gneiss
	Limestone	Marble
	Shale	Slate
	Sandstone	Quartzite

What made these rocks change their form and their class?

B. How can water change rocks?

1. (Remember what you saw on your TV Science Program. You learned that water has some acid in it.) Do the following experiment.

MATERIALS NEEDED:

Limestone Dish Vinegar

PROCEDURE:

Put a small piece of limestone into a little vinegar.

RESULTS:

CONCLUSIONS: (What does this tell us about how water changes rocks?)

2. In what other ways can water change rocks?

G. How can plants change rocks?

1. Do the following experiment. (NOTE: Plaster of Paris is a real rock.)

MATERIALS NEEDED:

Shoe box cover
Plaster of Paris
Lima bean seeds
Water
Towel

PROCEDURE:

Mix some plaster of Paris with water. The mixture should be fairly thin and easy to pour. Pour this mixture into a shoebox cover. Lay some Lima bean seeds on top of the plaster. Cover the seeds with a wet towel. Keep the towel wet for a week.

At the end of a week remove a few of the seeds.

RESULTS:

CONCLUSIONS: (How does this show us that plants can change rocks?)

2. What do the roots of plants "look for" in rocks?

D. How do the forces of weather change rocks?

1. Do the following experiment.

MATERIALS NEEDED:

Rock (limestone or sandstone)
Water
Scale
Plastic bag

PROCEDURE:

Weigh the rock. Record its weight. (Notice that your rock is porous.) Soak the rock overnight in water. Place the soaked rock in a freezer. Leave it there for a few hours. Take it out and weigh it. Record its weight. (Does the rock still look porous?)

RESULTS:

Weight of dry rock ______________________________

Weight of soaked rock ______________________________

Appearance of dry rock ______________________________

____

Appearance of frozen rock ______________________________

____

Appearance of rock after it has thawed ______________________________

____

CONCLUSIONS: (What did the experiment tell us about the effect of weather on rocks?)

2. What other weather factors besides temperature and moisture affect rocks?

E. How have climatic forces affected rocks? (Weather is what happens from day to day; climate is weather over a long period of time.)

1. Find out what a glacier is. Write about it.

2. Which parts of Wisconsin were covered by a glacier?

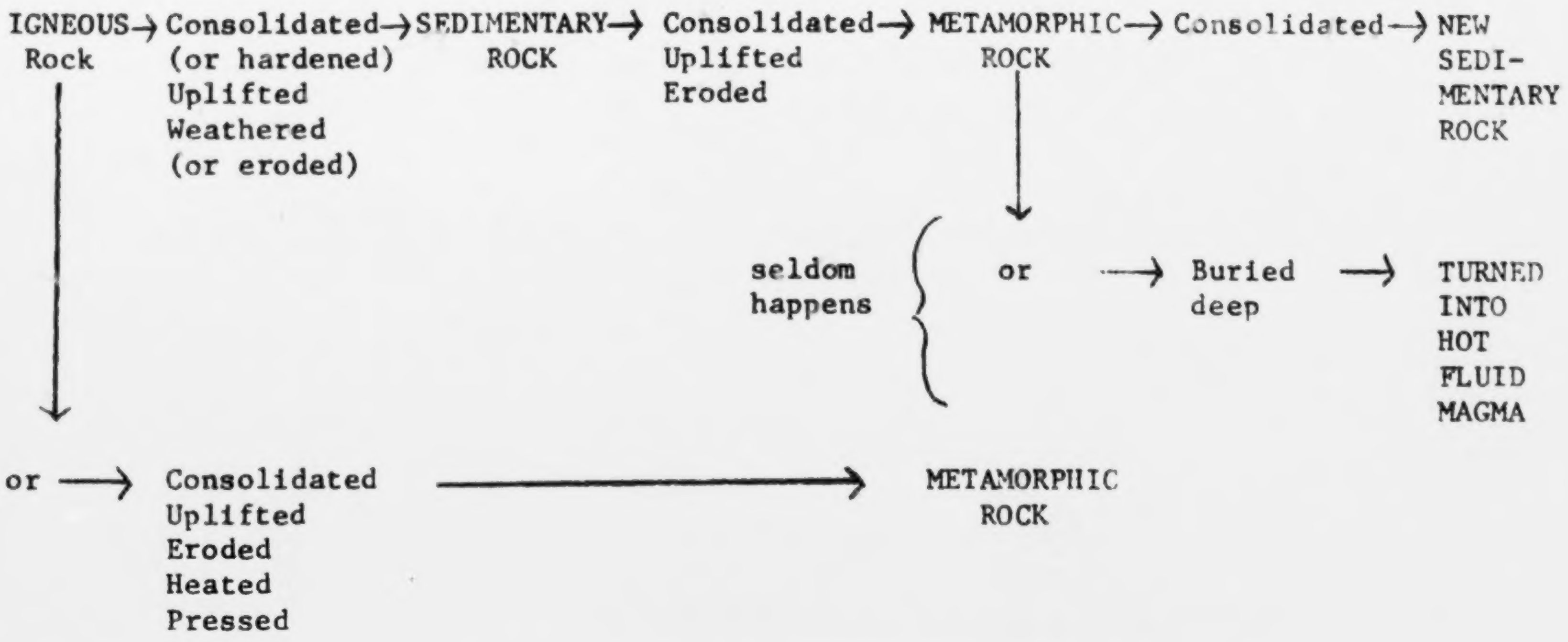
3. Which parts of Wisconsin were not covered by a glacier?

4. Look at a rock from the glaciated area of Wisconsin and look at one from the unglaciated area. What differences do you see?

5. How do glaciers affect rocks?

F. You have seen how rocks can change their form. Study the rock cycle below. Explain what it means.

ROCK CYCLE


IGNEOUS Rock
Consolidated (or hardened) Uplifted Weathered (or eroded)
SEDIMENTARY ROCK
Consolidated Uplifted Eroded
METAMORPHIC ROCK
Consolidated
NEW SEDIMENTARY ROCK
seldom happens
or
Buried deep
TURNED INTO HOT FLUID MAGMA
or
Consolidated Uplifted Eroded Heated Pressed
METAMORPHIC ROCK

My explanation:

G. Can rocks change into anything besides other rocks?

See if you can draw a rock-soil cycle.

WAS YOUR HYPOTHESIS CORRECT? DO ROCKS DIFFER AND CHANGE?

VIII. Why are rocks important to us?

A. See how many rock materials you can find that are used for building.

B. Make a list of metals used in industry that come from rocks. Explain their uses.

C. List the precious stones or gems that come from rocks.

D. List some fuels that come from rocks.

E. In some cases man has "overmined" his rock resources. They have been used up and it takes millions of years to make more. What is man doing to take the place of this loss?

F. Sometimes man does not mine all of a certain resource he finds in rocks. An example is diamonds. There are diamonds in the world which are still in the rocks and man has no plans for mining them in the near future. Can you see why?

G. Do you think we should make an effort to save or use our rock resources conservatively? Why or why not?

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Treatment of: how rocks are made; the wearing away of rocks; life in rocks; uses of rocks.

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FILMS

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11 min. Color.

Rocks: Where They Come From. Coronet, 1963.
11 min. Shows effects of heat, water, and pressure on rocks. Simple film.

Rocks and Minerals. Coronet, n.d.
11 min. Describes the three classes of rocks -- igneous, sedimentary, and metamorphic -- and relates them to the natural conditions which produced them.

Surface of the Earth. Audio-Visual Education Corporation, 1959.
11 min. Color. Shows the process of rock formation, effect of water and wind, causes and effects of glaciers, hot springs, earthquakes, and volcanoes. Explains how mountains rise from the earth and are slowly worn away along with the formation of caves and caverns.

Treasures of the Earth. Churchhill, 1958.
11 min. Color. Makes use of animation to depict changes in the earth's crust, and the formation of mineral deposits by natural forces

The World Is Born. Walt Disney, 1955.
20 min. A biography of the first two billion years of the earth.

FILMSTRIPS

Changing Surface of the Earth. McGraw-Hill, 1953.

The Conservation of Minerals. Eye-Gate House, n.d.

Mineral Conservation Today. Society for Visual Education, 1963

Rocks Around Us. McGraw-Hill, 1954.

Using Our Minerals Wisely. Encyclopedia Britannica Films, 1961.

Work of Internal Sources. Society for Visual Education, 1959.

STUDY PRINTS

Common Rocks and Rock-Forming Minerals (set of 8 prints). Society for Visual Education, 1964.

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Igneous and Metamorphic Rocks (set of 6 prints). Instructional Aids, Inc., 1965.

Dane County Geology Field Trip
and Slide Set

The slide set was shown both before and after the field trip.

Stops were made during the trip according to the purposes and discretion of the teachers. Students were allowed to collect rock specimens for their collections.

DANE COUNTY GEOLOGY FIELD TRIP

(Objectives)

Each student should display through discussion and written work:

1. a growing awareness of his or her environment,
2. an understanding that the earth around him is in layers (feeling of structure),
3. an understanding that early plant and animal life can be studied through fossils found in these layers, and
4. an understanding that the earth is not a static thing but that it has always been changing and will always continue to change.

DANE COUNTY GEOLOGY FIELD TRIP SLIDE SET

LVM School-aerial	1. Have you ever wondered what kind of material your home and school are built on?
Woodvale Street outcrop of Jordan Standstone	2. The material that your homes and school are built on is called Jordan Sandstone. Scientists believe this sandstone was laid down about 400 million years ago when an ancient sea covered the area. You can see the sandstone here in a small outcrop on Woodvale Street.
Map of Four Lakes and Yahara River	3. Scientists also believe that the lower areas around the Yahara River were once part of an ancient lake bed. Here you see the flow of the Yahara River through the Four Lakes.
View of lower areas of Yahara from Nob Hill	4. At one time the Yahara River probably extended across this area (as seen from Nob Hill) all the way to Dane County Coliseum. Later this area became a marsh and was very likely still a marsh when the first European settlers came to Madison.
Marsh area with Coliseum in	5. A small marsh still remains between Lake Monona and the Coliseum. What do you think the future of this marsh and the wildlife that inhabits it might be?

Arboretum sign	6. The Wisconsin Arboretum remained a marsh after the last glacier left Wisconsin.
Arboretum-long view	7. This "Arboretum" marsh was very popular with the Indians. Can you guess why?
View of Arboretum	8. Indians used materials from its trees to build canoes and to make bows and arrows. They ate the wild berries and nuts that grew there, and they hunted game which was abundant. They used the plant life of the area to weave mats and coverings for their wigwams and to make medicine. Do you suppose the driver of this red truck is aware of the value and the beauty of the Arboretum as he drives by?
Sand and gravel pit-Memorial School area	9. We can thank the last Wisconsin glacier for many spendid things. For example, the sand and gravel in this hill was bulldozed to this spot by the glacier. The sand and gravel industry supplies jobs for many Wisconsin people.
Back of sand and gravel pit-Memorial school area	10. At the back of this hill we can see numerous rocks of various sizes. What kind of rocks might these be? (Igneous) From what places do you suppose they were brought here? (Northern Wisconsin, Northern Michigan, Canada) Can you guess why they are rounded and have smooth surfaces? (Weathered by glacier)

Map of Dane County-
aerial

11. The glacier covered more than half of the area on this map. The area in the bottom left corner of the map is known as the "Driftless Area". Most scientists believe that the last Wisconsin glacier did not cover this area. What main difference can you see between the two areas? (Many rivers in Driftless Area - many lakes in glaciated area.)

Aerial view of the
glaciated area

12. This is an aerial view of an area covered by the last Wisconsin glacier. As the glacier went through this area it scraped off hilltops, filled in valleys, and improved farmlands with rich soil and leveled lands. It left many lakes, and because of poor drainage, many marshes.

View of Driftless
Area from top of
Camel Hill looking
toward Pine Bluff

13. This is a view of the Driftless Area taken from the top of Camel Hill. Most scientists believe that this area was untouched by the glacier except to receive loess or flour-like dust which was blown across the area by the strong winds that accompanied the glacier.

Voss Park

14. Directly east of Camel Hill is Voss Park. An eratic boulder brought to this area by the glacier highlights this small park. Voss Park is located right on the terminal moraine of the glacier. (As you look east from Voss Park toward Madison you can see the glaciated area. As you look west from Voss Park toward Camel Hill and Blue Mounds, you can see the Driftless Area.)

Camel Hill Sign

15. The outcrop on the top of Camel Hill is Platteville limestone or dolomite. Some fossils can be found in this limestone. There is a limestone products plant at Camel Hill.

Contact zone- Platteville limestone and St. Peter sandstone	16. Camel Hill also pinpoints a place where St. Peter Sandstone comes in contact with Platteville Limestone.
Blue Mounds from Camel Hill	17. The structural plain between Pine Bluff and Camel Hill is all St. Peter Sandstone. Can you see two blue mounds in the distance? These mounds were the most prominent early landmarks in the region, and they were mentioned by many travelers. The church steeple in the distance is located in Pine Bluff.
Outcrop below Camel Hill on way to Pine Bluff - long view	18. On the way to Pine Bluff you can see this outcrop of St. Peter Sandstone. Outcrops like these are characteristic of the Driftless Area, but you will not find them in the glaciated area. Can you quess why? (These outcrops were eroded from sandstone hills. The glacier scraped off these hilltops and reground the sandstone to sand. Many hills in the glaciated area are sand and gravel hills deposited by the glacier.)
Outcrop close-up	19. What tools did nature use to sculpture this outcrop of sandstone? (Nature sculptured this dramatic outcrop using wind, sand, water, and chemicals as her tools.)
Outcrop close-up	20. Someday this sandstone will be part of our soil. How many soil-makers can you see in this picture?

Pine Bluff	21. Pine Bluff was named for the nearby "Pine Bluff". It is a small unplatted settlement about the crossroads of County Trunks P and S.
Pine Bluff Church long view	22. The Pine Bluff Church, St. Mary's Catholic Church, was built in 1852-54. It was the center of an early German settlement.
Pine Bluff Church - close-up	23. Early settlers used what they saw around them for building materials. What do you suppose they used to build this church? (The church is made of native sandstone.)
Pine Bluff Sandstone rock ledge - long view	24. Pine Bluff was named for this sandstone rock ledge or bluff. On this bluff there is a grove of mountain pines, a tree unusual in this part of the state. This pine bluff was another of the landmarks used by early travelers.
Pine Bluff - close-up of pine trees	25. The pines on this bluff were present 9,000 years ago. Then as the glacier receded, hardwoods moved in. Can you guess why these pines continued to hold their place in this area? (No other plant could replace them in the dry, thin soil in the shade of the pines.)

Klevenville Quarry-long view	26. St. Peter Sandstone found in the Klevenville Quarry is a massive (not layered) sandstone. Above this sandstone is the flat lying, layered Platteville Limestone.
Klevenville Quarry - close-up of sandstone	27. This sandstone is basically white, but it is colored due to iron stain.
Klevenville Quarry	28. The sandstone is sent by these conveyor belts to the quarry plant where it is ground into sand...
Klevenville Quarry - train loading	29. Then loaded onto railroad cars. The sand is then shipped to its new owners who use it in over 150 different ways. How many uses for this sand can you think of? (Foundry molds, glass, ceramics, cleaning abrasives, etc.)
Platteville Limestone, road cut	30. The limestone seen in this road cut is Platteville Limestone. This is the same limestone that is found on Camel Hill, but it is of a little different composition. Many fossils can be found in this rock.

Swallows' homes in sand

31. Man isn't the only living thing to make use of sand and sandstone. Can you guess what kind of a living thing might make its home in this sand hill? (Swallows)

Erb Quarry-Galena Limestone

32. Around the corner to the left from the swallows' homes you can see this Galena Limestone Quarry. This limestone is not much different from Prairie du Chien Limestone (also found on PD at Wingra Redi Mix Company) except that it contains an index fossil of a marine sponge.

Index fossil - close-up

33. This is a picture of the index fossil, a marine sponge, found in the Galena Limestone. (An index fossil is ued to identify the formation in an area. It must:

a. be a fossil or trace of a plant or animal that lived only during the time that the rock was forming,
b. be easily recognized, and
c. be easy to distinguish from other fossils.

Erb Quarry - close-up

34. Shale and chert can also be found in this limestone quarry. How many signs or clues can you see here that tell us that some day these rocks will be soil?

Nine Mounds Road

35. The ridge you see in the background is part of a terminal moraine. The land you see in the foreground is part of an outwash plain. Nine Mounds Road runs north and south across Nine Mounds Prairie. Can you guess how the prairie and the road received their names? (The prairie was given its name by a party of 10 or 12 early settlers of Verona, Wisconsin who discovered nine circular Indian mounds in the area in the summer of 1840.)

Igneous rock quarry	36. The rock you see in this quarry is mostly igneous rock which was brought here by the last Wisconsin glacier. These rocks are located near the terminal moraine. Why do you suppose they are located here and not farther away from the glacier? (As water from the melting glacier poured over and eroded parts of the terminal moraine, it carried rocks of different sizes with it. The larger rocks were dropped first and can be found near the moraine.)
Igneous rocks - close-up	37. There are many kinds of igneous rock in this quarry. How many different kinds can you see?
Igneous rock - granite	38. What kind of an igneous rock might this red rock be? Why do you think so?
Wingra Sand and Gravel Quarry - long view	39. Perhaps you have noticed the Wingra Stone and Redi Mix Company as you traveled between Madison and Verona.
Wingra Quarry - sand and gravel	40. How many different colors of soil can you see in this quarry? What might the sand and gravel in this quarry be used for?

Wingra Quarry - Cut	41. One of the main rocks utilized by the Wingra Company is Prairie du Chien Limestone (dolomite) which can be seen in this cut on the top of the hill directly to the west of the gravel pit.
Wingra Quarry	42. The gray rock in this quarry is more limy than the lighter colored rock. This limestone is the exact rock in which ores such as pyrite and zinc are found and mined in Wisconsin. But that is still another story.

DANE COUNTY GEOLOGY FIELD TRIP GUIDE FOR TEACHERS
(approximately 55 miles)

INTRODUCTION

Over a period of hundreds of millions of years natural forces have been hard at work shaping the landscape into what we see today. High mountains of crystalline rock once covered the state; they were eroded by wind and water until they were nothing more than rolling hills. Then the whole state sank beneath the sea. Altogether scientists believe Wisconsin was submerged beneath the sea five times. Rivers draining the landscape carried sediments which were deposited in the sea to form sandstones and shales. Animals and plants living in the sea deposited calcium carbonate and built reefs to form rocks which are now dolomite, a magnesium-rich limestone. The deposits build up in the sea when the land was submerged were partially or completely eroded during the times they were uplifted above sea level. Rain, wind, and running water helped to carve the land surface during these times. Finally, nature's bulldozers invaded Wisconsin from the north. They smoothed the hill tops, filled the valleys, and left a deposit of glacial debris over all except the southwest quarter of the State where we may now see the land as it might have looked a million years ago.

#

THE ELVEHJEM AREA

The land your homes and school are built on and the land you walk on every day was laid down about 460 million years ago when one of the ancient seas covered the Elvehjem area. Originally deposited as sand, this sediment gradually became compressed into solid rock by pressure. This rock is now called Jordan Sandstone. It can be found listed on your geological time chart in the Upper Cambrian period of the Paleozoic Era. Note also that the now extinct trilobite lived during this time. (Trilobite-a segmented arthropod.)

Many hills and ridges in the Madison and Elvehjem area are held up by another sedimentary rock which was laid down in the beginning of the Ordovician period. On your time chart* this rock is listed immediately above Jordan Sandstone. This sedimentary rock is called Prairie du Chien dolomite. This dolomite was originally a limestone. This limestone became dolomized when the original calcium in the rock was replaced by magnesium. We shall see some of this dolomized limestone during our trip.

*Wisconsin Geologic Time Charts were provided by the ESEA Title III Local Materials Project of IMC, Madison Public Schools.

THE YAHARA RIVER AREA

The Yahara River is supposed to have received its name from the Winnebago word meaning "catfish" the former (and still common) name of the stream. The actual Winnebago word for catfish, is Howixra (Ho' wic ra). Historians believe the name Yahara is either a bad translation of the word or was greatly distorted in being "simplified" for speakers of English.

The source of the Yahara is in the extreme southern border of Columbia County. It flows into Dane County, passes through Windsor, Burke, and Westport, through the Four Lakes, then through Pheasant Springs and Dunkirk into Rock County to join the Rock River.

The lower areas around the Yahara are thought to be part of an ancient river bed. At one time the river probably extended out as far as the Dane County Coliseum. This area later became a marsh area and was probably like this when the first white settlers came to Madison. A small marsh still remains between Lake Mendota and the Coliseum. At the present time, this marsh area is being filled in to provide land for future building.

#

THE ARBORETUM AREA

The Wisconsin Arboretum remained a marsh after the last glacier left the area. This marsh was very popular with Indian tribes. In fact, it was so popular with so many tribes, it was once described as a "beehive of activity".

Indians used materials from its trees to build canoes and to make bows and arrows. They ate the wild berries and nuts which grew there, and they hunted game which was abundant. They used the plant life of the area to weave mats and coverings for their wigwams and to make medicine.

As Madison was settled and continued to grow as a town, people began to worry about the loss of the land as "it used to be". Some people wanted to set aside an area for study and research. Many problems had to be solved, and today our Arboretum is considered one of the most beautiful and exciting places for nature study in the world.

#

HIGHWAYS 12 & 14 AND SOUTH GAMMON ROAD

(MEMORIAL SCHOOL AREA)

This hill is composed of a sandy-like material peppered throughout with rocks of various sizes. These rocks have a smooth surface and rounded edges. This is the kind of material that was bulldozed to this part of Wisconsin by the glaciers. The rocks are igneous rocks such as granite and basalt. They originated in Northern Wisconsin, Northern Michigan, and Canada where volcanoes were active millions of years ago. The rocks have been weathered to their present appearance by the action of the glacier that brought them here.

If this material were to be consolidated by pressure, it would become a sedimentary rock called conglomerate.

#

CHARACTERISTICS OF THE GLACIATED AREA

The following is a list of the outstanding characteristics of the landscape of Dane County which was affected by the last Wisconsin glacier

1. Scraped off hilltops.
2. Filled in valleys.
3. Improved farm lands (level land, rich soil).
4. Lakes (still filling up-succession).
5. Many marshes because of poor drainage.
6. Not many trees.
7. No outcrops.
8. Large amounts of sand and gravel (these are now used in Wisconsin industry, highway building, etc.).
9. Large boulders and stones of rock not formed in this area.
10. Recreation areas around lakes.

#

MINERAL POINT ROAD

Mineral Point Road was so named because it joined Madison with Mineral Point. The name has been used since the earliest days of Madison's settlement.

Another name for Mineral Point Road is the Blue Mounds Road because it also joins Madison with Blue Mounds.

The part of Mineral Point Road from Pine Bluff to Blue Mounds coincided with the Military Road which followed an old Indian trail. The part of Mineral Point Road from Pine Bluff to Madison coincided with Speedway Road.

From Madison to Camel Hill, Mineral Point Road runs through the glaciated area. From Camel Hill to Mineral Point the road runs through the driftless area.

#

CAMEL HILL AREA

Camel Hill is located about two miles east of Pine Bluff on County Trunk S. (County Trunk S is also known as Mineral Point Road.)

Camel Hill pinpoints a place where St. Peter Sandstone comes in contact with Platteville Limestone. The structural plain between Pine Bluff and Camel Hill is all St. Peter Sandstone. This sandstone is made of quartz and is banded in reds, colors caused from iron stains. The outcrop on the top of Camel Hill is Platteville Limestone or dolomite. Some fossils can be found in this limestone.

There is a limestone products plant in Camel Hill.

Directly to the east of Camel Hill (on S or Mineral Point Road) is the terminal moraine. Voss Park is located here. An eratic boulder, brought to this area from Northern Wisconsin, Norther Michigan, or Canada, highlights this small park.

As you look east from this park toward Madison, you can see the rolling plains sculptured by the last Wisconsin glacier.

As you look to the west from this terminal moraine area toward Blue Mounds, you can see the dramatic landscape of the Driftless Area. The Driftless Area gives us a picture of the way Wisconsin probably looked before the last glacier.

#

BLUE MOUNDS

Niagarian dolomite can be seen on the very top of Blue Mounds. It once covered the whole area, but it was eroded away, leaving only a remnant on the top of Blue Mounds.

Left of the mounds is a hill of Marquoketa shale.

The Blue Mounds are two hills joining at the base. East Blue Mound is in Dane County while West Blue Mound is in Iowa County. When seen from a distance, these hills do indeed look like "blue mounds".

Visable for many miles around in every direction, these "mounds" were the most prominent early landmark in the region, and were mentioned by many early travelers.

#

PINE BLUFF

Pine Bluff is a descriptive name for the rock ledge of bluff running east and west through N sections 33 and 34, Cross Plains. (See Dane County map.) On this bluff there is a grove of mountain pines, a tree unusual in this part of the state. (This kind of pine was present in this area 9,000 years ago. Then as the glacier receded, hardwoods moved in. These pines persisted because no other plant could replace them in the dry, thin soil in the shade of the pines.) This pine bluff was one of the earliest local landmarks, the road "from Blue Mounds to Four Lakes" running below and turning by it.

The Village of Pine Bluff was named for the nearby "Pine Bluff". It is a small unplatted settlement about the crossroads of County Trunks P and S (Mineral Point Road).

The Pine Bluff Church, St. Mary's Catholic Church, was build in 1852-54 and was the center of an early German settlement. The church is made of native sandstone.

#

CHARACTERISTICS OF THE NON-GLACIATED AREA

(DRIFTLESS AREA)

Scientists hold different theories concerning the "Driftless Area" part of which is located in the southwest corner of Dane County. One theory states that this area was untouched by the last Wisconsin glacier except to receive loess or flour-like dust which was blown across the area by the strong winds that accompanied the glaciers. Scientists who hold to this theory believe that mountains which were formed in the Precambrian Era by volcanic action (and which have long since disappeared) protected this area from the glacier. They believe that this high land held back the ice as it moved around the area in lobes.

Another theory states that glaciers were in this area.

Another theory concerning the plant and animal life of Wisconsin states that animals and plants went out from this area to repopulate the glaciated area after the glacier retreated.

The following is a list of the outstanding characteristics of the landscape of the "Driftless Area".

1. Conical shaped hills (Sandstone weathers in this shape. Hills were also formed in this shape as water ran into holes in the glacier as it melted. A scientist would dig into the hill to find out the material it was composed of before he would form a theory or hypothesize as to how the hill was formed).
2. About 1/3 of the land in valleys (When the first explorers came to this area about 1/3 of it was prairie with waving grasses and wildflowers broken by steep cliffs of rock).
3. No marshes because of good drainage.
4. Many rivers because of good drainage.
5. Many trees (Madison School Forest is in this Driftless Area).
6. Outcrops (Some scientists believe that as the glacier melted and retreated water from the melted glacier eroded areas that were non-glaciated).
7. Caves.
8. Zinc and lead mines.

KLEVENVILLE AND THE KLEVENVILLE QUARRY

The Village of Klevenville was named for an early Norwegian settler and promoter of the village, Ivor K. Kleven. Kleven had a lumber yard and built several buildings in Klevenville including the Klevenville depot in 1881.

St. Peter Sandstone found in the Klevenville Quarry is basically white but is colored due to iron stain. This is a massive sandstone (not layered). This sandstone has over 150 uses (foundry molds, glass, ceramics, cleaning abrasives, etc.). Above this sandstone is the flat lying, layered Platteville limestone.

#

PLATTEVILLE LIMESTONE

Platteville limestone can be found on both sides of a road cut on County Trunk P just before the last curve in the road before reaching Highway 18.

This is the same limestone as was found on Camel Hill, but it is of a little different composition. Fossils can be found in this rock.

#

GALENA LIMESTONE (DOLOMITE)

This Galena limestone quarry is located five miles west of Verona on Highway 18 and south on Erb Road. In addition to Galena limestone, chert and shale can be found here.

This limestone is not much different from Prairie du Chien limestone except that it contains an index fossil or a marine sponge. (An index fossil is used to identify the formation in an area. It must be the fossil or trace of a plant or animal that lived only during the time the rock was forming. The fossil must be easily recognized and easy to distinguish from other fossils.)

The Galena limestone, like Prairie du Chien limestone, is interlaid with white layers of chert. Chert is practically a solid quartz (a silica) laid down originally as a jellied mass between layers of limestone. It is a rock of organic or precipitated origin. (Precipitate in chemistry means a substance in a concrete state separated from a solution in consequence of some chemical or physical change.) As a secondary rock, chert is found between layers of dolomite (limestone). Chert is classified as a sedimentary rock. It is sometimes banded. Chert looks like flint or agate. It might have a little limestone in it.

At the base of the Galena limestone is Decorah shale.

At the entrance of this quarry you can see swallow homes built into sand mounds.

#

NINE MOUNDS ROAD

Nine Mounds Road runs through Nine Mounds Prairie between County Trunk PD and State Highway 151 & 18 just west of Verona.

Nine Mounds Prairie was named by a party of 10 or 12 early settlers of Verona who discovered nine circular Indian mounds in the area in the summer of 1840. The mounds can no longer be seen in the area.

#

TERMINAL MORAINE AND ROCK OUTWASH

(Located on the corner of Nine Mounds Road and County Trunk PD)

There are many igneous rocks of large size in this outwash quarry. The following is a list of some of the most common igneous rocks found there.

BASALT-dark greenish gray to black-dense, microscopic crystals that often form columns

GABBRO-greenish-gray to black-coarse crystals

GRANITE-white to gray, pink to red-tightly arranged medium-to-coarse crystals

OBSIDIAN-black, sometimes with brown streaks-glassy, no crystals, breaks with a shell-like fracture

PUMICE-grayish-white-light, glassy, frothy, fine pores, floats on water

RHYOLITE-gray to pink-dense, sometimes contains small crystals

SCORIA-reddish-brown to black-large pores, looks like furnace slag

SYENITE-gray to pink and red-coarse crystals, resembles granite but has no quartz

Note the fence rows on the way to this quarry. There are a few plant relics here from the prairie days. The farmer allows plants and brush to grow along his fence to protect wildlife.

Note the layers of soil under the corn field.

Notice the drying mud and its characteristic pattern in the bottom of the quarry. One day this could turn into shale.

#

COUNTY TRUNK PD

County Trunk PD follows a "dropping moraine" area from Highway 18 toward Nine Mounds Road and the Verona outwash plain area and terminal moraine. All of the area to the left of this road as you travel west is the moraine area. Note the long irregular gently curving, hummocky ridges of drift which are distinctive terminal moraine topography. Between the ridges the surface of the area is rough, and is covered with knolls and a great number of shallow depressions.

This moraine was deposited as the glacier progressed and receded the Randall School area (which is on the Milton Morane).

#

WINGRA STONE AND REDI MIX COMPANY

AND

PRAIRIE DU CHIEN LIMESTONE QUARRY

(Located on the corner of Highway 18 and County Trunk PD)

One of the main rocks utilized by the Wingra Company is Prairie du Chien limestone (dolomite) which can be seen in a dramatic cut on the top of the hill directly to the west of the company building site. This rock is called Prairie du Chien limestone (dolomite) because it was first studied near that city.

Prairie du Chien dolomite was originally laid down as limestone. Rock that has been dolomized has had the calcium in the original composition replaced by magnesium. The lighter layers are more dolomized than the gray layers which are still very limy. Dolomization is a crystalization process so there are only a few fossils found in this limestone. Ancient seaweed is one fossil that can be seen in this rock.

One way to determine whether limestone has been dolomized is to examine it for crystals. In dolomite, crystals are round so light will follow the round shape of the crystal. Limestone does not contain this curved crystal. (Dolomite and limestone are used and discussed somewhat interchangeably.)

This dolomized limestone holds up most of the tops of the ridges in the Madison area. Another interesting place at which to see this sedimentary rock is in the Shorewood Quarry.

This dolomized limestone is the exact rock in which ores such as pyrite, zinc, etc. are found and mined in Wisconsin. Five hundred men are still working in Wisconsin mines today. Southwest of Madison in Shullsburg 12 miles of underground tunnels can be found. The only privately owned mine in Wisconsin is in Mineral Point.

CHEMISTRY

BEHAVIORAL OBJECTIVES:

The child will be able to explain in his own words and demonstrate through classroom activities that he understands the following:

1. There is a vast variety of materials and objects in different forms in nature.
2. All matter is basically composed of one or more of a small number of simple building blocks--the chemical elements. These elements are composed of very small particles called atoms.
3. Completely new substances can be formed, rapidly or slowly, by combining a wide variety of elements in varying porportions. These new substances (compounds) are composed of very small particles called molecules which are always in motion.
4. Energy is involved in the physical and chemical changes of matter.
5. The most important chemical process in the world is the making of starch and sugar by plants.
6. Man adapts the elements for his use.
7. Elements that are cycled through the physical environment provide basic essentials for life.

#

CHEMISTRY

ACTIVITY 1

Purpose: To help the children discover the tremendous variety of materials and objects in different forms in nature.

Materials needed:

Glass of water
Book
Glass or jar
Eraser
Sugar
Cracker

Procedure: Place these materials where everyone in the class can see them. Have a student identify them. Tell the class that this is the beginning of an investigation to find out how materials are alike and different. Guide the discussion with questions as "What do you think sugar is made of?" "Is the sugar just sugar or do you think it might be made of something else?" "What is in the empty glass?"

Discuss the need to examine many things to see how they are alike or different. Explain that in science, it is important to describe things carefully and that scientists use special words, some familiar some unfamiliar, to describe materials. Such words are hardness, brittleness, luster, elastic, soluble, shape, size, odor, weight, etc.

Assign the children to bring to class small samples or objects to examine.

#

CHEMISTRY

ACTIVITY 2

Purpose: To discover some of the physical properties that differ in materials.

Materials needed:

Small samples and objects brought to the class by students
A yardstick

Procedure: Have the yardstick placed in plain sight in the classroom before the students arrive. As the students arrive, have them place their materials where everyone can see them. Pass out work sheet "What Is It?" Tell the children that each of the clues on this page describes a property of an object in this room. For example, size is the property described by "longer than this page." Solid describes the "phase" or "state" of the object. Other phases or states are liquid and gas.

Have the children try to name the object. After they have guessed what the object is, have them list other clues that might have been used to help to identify the object. Use the chart on page 2 of "What Is It" to show the property described by each clue.

Have each student think of something else in the classroom. Have them describe its properities under the heading "Classroom object I am thinking of." Explain that they should not tell anyone else what they are describing. When students have finished, have one student at a time describe his object. If they are described well, other students should know what they are.

#

WHAT IS IT?

ACTIVITY 2

Name a common object in the classroom that fits all of these clues.

1. It is solid.
2. It has six flat sides.
3. It has eight corners.
4. It is longer than this page.
5. It is narrower than this page.
6. It will not dissolve in water.
7. It has black markings.
8. It is hard.
9. It is smooth.
10. It will not break if it is dropped, but it can be broken.

What do you think the object is?____.

Can you think of any other clues that might have been given to describe this object?

11.

12.

13.

14.

15.

16.

17.

18.

19.

20.

(See next page.)

ACTIVITY 2

Property	Classroom object described on page "What Is It?" Name of Object: ______________________	Classroom object I am thinking of. Name of Object: ______________________
	Solid	
	Black markings	
	Six flat sides Eight corners	
	Longer than page Narrower than page	
Brittleness		
Texture		
Soluble		
Hardness		

CHEMISTRY

ACTIVITY 3

Purpose: To help the children discover:

a. that some materials are neither solids nor liquids but in-between substances called simi-solids and that their degree of solidity varies with temperature, and

b. that some materials may be a combination of the states of matter.

Materials needed:

Stones or rocks of various sizes
Muddy water
A partly inflated balloon
Paste
A rubber sponge
A bottle of soda pop
Salt
Other materials brought from home by students

Procedure: Have one item shown at a time. Have the students write the name of the object in the column that they think is correct on work sheet "Materials of the Earth." Ask questions like those that follow to guide the children in deciding in which column to place the item.

Does it have a definite shape?
Is it fairly hard?
Can you pour it into a glass?
If you can pour it into a glass, does it change its shape?
Does it hold its shape when you squeeze it?
Can you see it?
If you could heat it, would it change its shape?
If you would cool it, would it change in any way?
Does it seem to belong in more than one column? (For example, what do you observe when you let muddy water stand?)

Ask the children if they can place the following kinds of matter in the right column.

coal
vegetable soup
chalk
chocolate ice cream soda
a tree
a scissors
fresh orange juice
a penny
a rubber sponge
flour
an insect
a shoe

Ask the children where they would put these kinds of matter if they were at room temperature.

toothpaste
molasses
butter
vaseline
thick paint

ACTIVITY 3

MATERIALS OF THE EARTH

SOLIDS	LIQUIDS	GASES

ACTIVITY 4

Purpose: To introduce the elements as the basic building blocks of matter.

Materials needed:

- A set of construction toys such as Tinker Toys, Erector Set, Lincoln Logs, etc.
- A dictionary

Procedure: Discuss with students how they have used construction toys. Discuss idea that the materials around them might also be constructed of simpler units. Have students suggest examples from their observations in which simple units are made into bigger structures such as flagstones in a walk, bricks in a fireplace, etc.

Use alphabet-dictionary analogy where the letters of the alphabet represent elements and the words represent the combination of elements (compounds and mixtures). Continue the analogy to sentences, paragraphs, and all the printing of a book.

Using a large dictionary, count the number of words on each of several pages, find the average number of words per page, then multiply this figure by the number of pages in the dictionary. (Use an unabridged dictionary if possible.) Discuss the fact that all of these words are made up of the 26 letters of the alphabet.

The notes of a musical scale could also be used for a similar analogy.

#

CHEMISTRY

ACTIVITY 5

Purpose: To have students collect as many elements as possible and to find out about their properties and uses.

Materials needed:

Textbooks
Encyclopedias
Other books
Charts
Etc.

Procedure: Discuss with children where they can find out about what elements are and where elements can be found.

Have the children find out the names of the elements and to list them on a large wall chart. The chart should allow space for the name of the element, its chemical symbol, its uses, where it is found in nature, etc.

A display could be made of some elements that can be obtained in a more or less pure form, such as silver and copper in coins, aluminum in foil, copper as wire, etc.

#

CHEMISTRY

ACTIVITY 6

Purpose: To help the children learn that the elements are composed of very small particles called atoms.

Materials needed:

Piece of sulfur
Stranded iron picture wire
Magnet
Scissors
Knife

Procedure: Review concept that all matter is made of chemical elements. Ask if anyone knows what the elements are made of. Discuss possible reasons for the wearing away of substances such as shoes wearing out, stone or wooden steps being worn down, etc. Discuss idea that the material may have been worn down in tiny bits too small to see.

Have a student break or cut the sulfur in half. Put aside one of the halves. Continue this procedure until only a tiny speck remains, and it is impossible to divide it further. Suggest that the students continue the breaking process in their imaginations. Discuss how far the breaking process could be carried on. Discuss idea that elements are composed of tiny bits or particles that all have the properties of the element. The smallest particle that still has these properties is called an atom.

Reinforce this concept by following the same procedure with a piece of iron picture wire (stranded). Have a student untwist the wire and remove one of the strands. Test the strand with a magnet. Cut the strand in half with a scissors and test it with a magnet again. Continue this process as far as possible, proceeding as above.

#

CHEMISTRY

ACTIVITY 7

Purpose: To help children learn that compounds are composed of very small particles called molecules.

Materials needed:

Sugar
Magnifying glasses
A knife
A razor blade
A hammer
Dark paper
A glass dish
Water

Procedure: Review concept that substances composed of more than one element are compounds. Explain to students that the smallest unit of a compound, composed of two or more atoms, is known as a molecule. For example, each molecule in sugar is the smallest single particle of the compound sugar.

Ask students what they would find if they divided the sugar molecule. (Since compounds are made of elements, and elements are made of atoms, molecules must be made up of atoms. Each sugar molecule is composed of three elements, carbon, hydrogen, and oxygen. Each sugar molecule contains 12 atoms of carbon, 22 atoms of hydrogen, and 11 atoms of oxygen. Its chemical formula is $C_{12}H_{22}O_{11}$.)

Have the students break a lump of sugar in half and discard one piece. Have them continue this process still further using such tools as a knife or a razor blade. As the pieces of the sugar become smaller, have them place the sugar on a dark paper to improve visibility. Have them observe the grains of the powdered sugar on a glass dish with the dark paper underneath. Have several students observe the grains carefully while someone puts a single drop of water on them. What happens? (Separate sugar molecules leave the grains and move into the water.) When the grains have disappeared, all the sugar molecules have mixed among the water molecules. You can't see them because they are so tiny.

Ask the students how it can be proved that the substance sugar is still there. (By taste.)

#

CHEMISTRY

ACTIVITY 8

Purpose: To emphasize the concept that all matter is composed of small particles, atoms and molecules, and to help children learn that making solutions in water is an excellent way to show that visible amounts of matter may be reduced to invisible molecules and distributed throughout a substance.

Materials needed:

- Salt
- Sugar
- Kool-aid
- Instant coffee crystals
- Warm water
- Toothpicks
- Glasses or glass jars
- Magnifying glasses
- Cloth
- Filter paper
- Teaspoon

Procedure: Review with students how they can detect that the substance sugar might be in water, even when it is in pieces not big enough to see. (Taste.) Ask what tests might be used to detect salt, kool-aid, and coffee in water solutions. (Taste, color.)

Have the students dissolve a teaspoon of each of the substances, sugar, salt, kool-aid, and instant coffee crystals, in separate glass jars or glasses filled almost to the top with warm water. Stir thoroughly. Ask students to explain how the visible substances, sugar and salt, were reduced to invisible molecules. Ask again how they can detect whether salt and sugar are still present. (Taste.) Have students dip the ends of toothpicks into the solutions to get a drop to taste. Ask how they know the other substances, kool-aid and coffee, haven't really disappeared. (Color.)

Have students compare all of the solutions with a glass of tap water. Is there any difference in the appearance of the clear solutions of salt and sugar and the tap water? (No.) Ask students if they can see any particles in the kool-aid and coffee. (No.) Can they see any particles with a magnifying glass? (Not if completely dissolved.) Substances, if completely dissolved, are now divided into tiny particles the size of molecules.

Ask students if they think they can separate the tiny particles from the water if the solutions are filtered. Have the students try to filter the solutions through the cloth and the filter. Try tap water first. Have students wash the cloth and filter after each trial.

Discuss with students that making solutions in water is an excellent way to show how substances can be broken into particles so small that they cannot even be seen with a magnifying glass or filtered out through a fine filter.

#

CHEMISTRY

ACTIVITY 8

You have seen sugar grains disappear when mixed with water. We say the sugar has dissolved in the water. When substances such as the following are dissolved in water, how can we detect that these substances are still there?

Substances	Hypothesis as to proof of existance
1. sugar	____________________
2. salt	____________________
3. kool-aid	____________________
4. instant coffee crystals	____________________

Was each of your hypothesis correct?

1. sugar ____________________

2. salt ____________________

3. kool-aid ____________________

4. instant coffee crystals ____________________

Explain what happens when substances such as those above are dissolved in water.

____

____

Do you think that you could separate the sugar, salt, kool-aid and coffee crystal molecules from the water if the solutions are filtered?

Substance	Hypothesis	Was your hypothesis correct?
1. sugar	____________________	____________________
2. salt	____________________	____________________
3. kool-aid	____________________	____________________
4. instant coffee crystals	____________________	____________________

ACTIVITY 9

Purpose: To show that atoms and molecules can be made to collect into visible matter.

Materials needed:

Ice cubes
Tea kettle
Electric hot plate
Small towel
Tablespoon

Procedure: Ask students what three forms or states water molecules can exist in. (Solid, liquid, gas.)

Have a student put three or four ice cubes in a tea kettle and have the kettle put on the burner of a hot plate. Leave the lid off so students can see what happens inside. Ask a student what is happening. (As the ice is heated, it melts and becomes water. It changes from the solid to the liquid state.)

When all of the ice is melted, have the lid put on the kettle. Bring the water to a boil. When steam issues from the spout, observe the steam that is formed. Observe the space next to the spout when the steam comes out. Can you see the steam here? (The space just in front of the spout should look like empty space.) Ask what this space is taken up by. (Water vapor which is invisible because it is colorless.)

Ask students how it can be proved that water vapor (gas) is a form of water. Have student wrap a towel around the handle of a tablespoon and hold the bowl of the spoon in the seemingly empty space in front of the spout. What happens? (Water vapor condenses on the spoon's cold surface.) What would happen if you put these drops of water into the freezer of a refrigerator? (They would freeze and become ice.)

Ask students if they can suggest how water gets into the air and from what source. Discuss how the entire water cycle, from water to vapor back to water, is an excellent illustration of the atomic theory.

#

CHEMISTRY

ACTIVITY 9

List the three forms or states water molecules can exist in.

1.

2.

3.

Draw a diagram and label the parts in each of the stages of the Tea Kettle and Water experiment.

MELTING ICE BECOMES WATER	BOILING WATER BECOMES STEAM	DROPS OF WATER FORM ON SPOON

How does water get into the air?______________________________________

List the sources from which water evaporates into the air.

1.

2.

3.

4.

5.

6.

7.

8.

ACTIVITY 10

Purpose: To show children that when solids melt, they absorb energy from their surroundings, usually in the form of heat.

Materials needed:

Saucepan
Ice cubes
Electric hot plate
Thermometer
Candle wax
Sugar
Butter
Chocolate
Jello
Other substances that will melt at a reasonable temperature

Procedure: Discuss experiences students have had with ice cubes in drinks. What happens to the ice cubes? Why does the drink stay cold as long as the ice cubes remain? (The following experiment will explain why.)

Fill a saucepan about half way with ice cubes. Add enough water to make the ice cubes float. Place the mixture over a hot plate. As the ice melts the water level will rise. Stir the ice-water mixture with the thermometer and have students note the temperature. (It should be 32°F or 0°C, the melting point of ice.) Have the water stirred and have the students record the temperature every 2 to 3 minutes. Also, have the students record any changes they observe in the appearance of the ice cubes. (The temperature should remain the same as long as any ice remains. The major change noticed will be the melting of the ice rather than the heating of the water.) Ask students if they can explain what causes the ice cubes to melt. (The heat energy from the hot plate goes into agitating the ice molecules until they separate from each other to form more water.) Ask students what they think will happen when all the ice cubes have melted. (The temperature of the water should begin to rise.)

Ask the students if they think that all substances melt at the same temperature. Ask students to suggest a way to discover the melting points of other solids. (Follow same procedure as above in melting ice cubes.) Have the students find the melting temperatures of some of the other solids listed above. (Melt the candle wax inside a can that is placed inside a pan of water. Ask students if they can explain why substances melt at different temperatures. (Substances melt at lower temperatures when the attraction of molecules in the solid are not very strong. The higher the temperature they melt at, the stronger the attraction of the molecules in a solid state.) Discuss why it is important to man that all substances do not melt at the same temperature.

#

CHEMISTRY

ACTIVITY 10

Chart I

Record the temperature of the ice-water mixture every 2 to 3 minutes. Describe any changes you notice in the appearance of the mixture. When the ice cubes have all disappeared, record the temperature of the water every 2 to 3 minutes.

ICE CUBES IN WATER EXPERIMENT		
TIME	TEMPERATURE	APPEARANCE

Chart II

Record the melting temperatures of each solid below.

Melting Temperature	
240°	
230°	
220°	
210°	
200°	
190°	
180°	
170°	
160°	
150°	
140°	
130°	
120°	
110°	
100°	
90°	
80°	
70°	
60°	
50°	
40°	
30°	
20°	
10°	
0°	
Substances	Ice

ACTIVITY 11

Purpose: To show students that when liquids change to gases they absorb energy from their surroundings, usually in the form of heat.

Materials needed:

Cups
Paper towels
Water
Oil

Procedure: Discuss changes in state of water molecules. Ask students what kind of energy is needed to melt snow and ice and to change water to steam. (Heat.) Ask if they can guess what happens when gases are changed to liquids. (Heat is removed.)

Have students dip a finger into water then hold the finger in the air. Ask what temperature sensation they feel. (Cool.) Have students dry their fingers and describe any change in temperature sensation they feel. (Warmer.) What happened? (Water absorbed heat from the body and gave the molecules sufficient energy to enter the gaseous state. The heat loss was sensed as a cooling of the skin.) Discuss other occasions when students have experienced this cooling. (After swimming, bathing, being caught in a sudden rain shower.)

Have the students try the same finger-wetting experience with other liquids. How does alcohol compare as a coolant? (Shows strong cooling effect since it evaporates more quickly than water or takes heat more rapidly from its surroundings.) Discuss why alcohol baths are used to bring down high fevers in persons who are ill.

How does oil compare as a coolant? (Hardly cools at all.) Discuss why lotions and oils are used to keep skin from "drying out."

#

CHEMISTRY

ACTIVITY 12

Purpose: To show that atoms and molecules of a substance dissolved in a solution can be made to collect (or grow) into visible matter called crystals.

Materials needed:

- Sugar
- Pan
- Electric hot plate
- Cloth
- Magnifying glasses
- Small jars
- String
- Pencils
- Paper clips

Procedure: Add three or more cups of sugar to one cup of boiling water in a pan. Stir until sugar dissolves. Cool. When cool, pour into small jars or glasses using folded cloth as a filter. Have students note that although sugar has disappeared from view, its presence can be detected by taste.

Hang a piece of clean string in the solution in each jar by fastening it to a pencil which is laid across the top of the jar. A paper clip should be fastened to the other end of the string to keep the string from floating up. Explain that the string forms a point or nucleus around which the crystals will form as the water evaporates.

Have students make a series of drawings which show day to day growth, color, and shape of crystals. Have students make their observations with magnifying glasses. Discuss what has happened. (Crystals have grown from a solution.) Such crystals grow when the atoms or molecules of a substance dissolved in a solution are deposited on a nucleus.

Students may eat crystals following final observation.

#

ACTIVITY 12

GROWING CRYSTALS FROM SOLUTIONS

Materials:

Procedure:

Results: Drawings based on observations.

DAY 1	DAY 2	DAY 3	DAY 4	DAY 5

Conclusions:

CHEMISTRY

ACTIVITY 13

Purpose: To help students think about molecules in motion.

Materials needed:

Shoe box
Large onion
A knife

Procedure: Discuss with students their experiences with evaporation. Discuss theories of why evaporation takes place. (Atoms and molecules move.) Discuss other ways they have observed that point to theory that molecules move.

Close all doors and windows in the room. Place an onion on the table in front of the room. Have students get ready to mark down the time the onion is cut. Cut onion in half. Quickly place one half of the onion on the table, the other in a covered shoe box. Have students mark down the time the onion odor reaches them. Discuss why onion odor reached students. Did it reach everyone at the same time? (No.) Why or why not? (Some people were farther away and had to wait for the molecules to reach them.)

Discuss the air in the room. Is it perfectly still? (No.) What could cause movement of air in the room? Will air movement help us to detect odor more rapidly? Why or why not? Discuss how hunters might use their knowledge of molecules in motion when they hunt.

Open shoe box and have students take a sniff. Why would odor be much stronger in closed box than in the room? (Molecules knocked off the onion are trapped in the air in the box. There are many more onion molecules in the air in the box than in the same amount of air in the room.)

#

CHEMISTRY

ACTIVITY 13

Purpose: To find out about molecules in motion.

Materials needed:

Procedure:

Close doors and windows.

Place onion on table.

Record time onion is cut. ____________________

Mark down time you notice onion odor. ____________________

Results and conclusions:

Did the onion odor reach everyone at the same time? __________

Why or why not? ________________________________

____

Is the air in the room absolutely still? ______________

List the causes of air movement in the room.

Does air movement help to detect odor more rapidly? __________

Why or why not? ________________________________

____

Explain how hunters might use this knowledge about molecules in motion when they hunt.

____

____

Explain why the onion odor in the shoe box was stronger than the onion odor in the room.

CHEMISTRY

ACTIVITY 14

Purpose: To reinforce idea that molecules move.

Materials needed:

Glasses
Liquid food coloring
Water

Procedure: Discuss ways molecules have been observed to move. (Evaporation, onion experiment, etc.) Have students suggest other ways of demonstrating this motion.

Have students fill glasses almost to top with water. When water is still, carefully place several drops of liquid food coloring (one or several colors) into the water. Discuss why students should be very careful not to touch or shake anything. (We want to see molecules move by "themselves.") Let the glasses stand and observe what happens. Students might want to speculate what might happen if two or more colors of food coloring are used in the same glass. Have students make a sketch of what they see every 2 to 3 minutes.

Let the glasses stand overnight. Guess how substances might look by morning. Make a final sketch of dye-water solution after 12 to 24 hours.

Some of the food coloring will settle on the bottom of the glass. Discuss why this happens. (Gravity.) By morning all food coloring molecules should have distributed themselves evenly among the water molecules.

#

CHEMISTRY

ACTIVITY 14

Purpose: To observe molecules move by themselves.

Materials needed:

Procedure:

Results:

		Final sketch-made 12-24 hours after first sketch

Conclusion:

CHEMISTRY

ACTIVITY 15

Purpose: To review concepts learned in previous activities.

Assignment:

Read: Probing into Science, pages 98-125
Science in Your Life, pages 51-73
Science Is Experimenting, pages 61-82

After reading the materials listed above, take notes to answer the following questions. Be prepared to discuss your answers in class.

Questions:

1. What is a molecule?
2. What three states can molecules be found in?
3. What two properties do all states of matter have in common?
4. Explain why a substance in a solid state keeps it shape?
5. What does melting a substance really do to the substance?
6. Why is it that a substance in a liquid state does not keep its shape?
7. Explain what happens when a liquid changes to a gas.
8. Why is it that most substances in a gaseous state are invisible?
9. Why is it that solids and liquids are visible?
10. What is meant by a physical change?
11. List two ways materials can be changed from one state to another.
12. Why is the change from water to ice a physical change?
13. Explain the difference between "melting point" and "freezing point."
14. Explain why the freezing temperature is sometimes called the dividing line between a liquid and a solid.
15. Explain the difference between a Celsius and a Fahrenheit thermometer.
16. What is the freezing point of water?
17. What is the melting point of water?
18. Explain the meaning of "boiling point."
19. What is the boiling point of water?
20. Do all liquids reach their boiling points at the same temperature?

ACTIVITY 15

21. Explain what is meant by evaporation.
22. How does boiling help to change water from a liquid to a gas?
23. Explain what is meant by condensation.
24. What happens when condensation occurs?
25. Explain what is meant by dissolving.
26. Explain what is meant by a solution.
27. Explain how some solids are changed by dissolving them in water.
28. Give an example of a solution where a solid has been dissolved in a liquid.
29. Give an example of a solution where a gas has been dissolved in a liquid.
30. Give an example of a solution where a liquid has been dissolved in a solution.
31. What is an atom?
32. About how many different kinds of atoms are there?
33. What is an element?
34. Why are elements called the building blocks of matter?
35. What is a compound?
36. In what states can a compound be found?
37. What is the name given to the chemists' abbreviation for an element?
38. What is the name given to the chemists' abbreviation for a compound?
39. Why do you think it is important to chemists all over the world to have symbols for elements which have been agreed upon by all nations?

#

CHEMISTRY

ACTIVITY 16

Purpose: To have students learn that when substances are put together to form a mixture, the substances involved retain their physical properties and can be easily separated.

Materials needed:

- Sugar
- Fine sand
- Jars or pans
- Dark-colored paper
- Toothpicks
- Magnifying glasses
- Water
- Filters
- Stirrers
- Iron filings
- Magnets

Procedure: Discuss with students the meaning of a mixture. Have students suggest ways to find out whether a substance is a mixture.

Have students prepare a mixture of granulated sugar and fine sand using equal parts of each. Give each student a small amount of the mixture on a piece of dark-colored paper and have them examine it. Has a new substance been produced? (No.) Ask how the mixture might be separated so that both substances can be recovered. (Pick apart grains or dissolve sugar in water, filter out sand, and evaporate water.) Have students separate substances in mixture.

Have students prepare a mixture of iron filings with an equal amount of sand, sugar, salt, etc. Have students give suggestions for separating these ingredients. (Magnets.) Have students separate substances in mixture.

#

CHEMISTRY

ACTIVITY 17

Purpose: To help students learn that a chemical change takes place when a completely new substance (one with different properties) is formed by combining two or more substances.

Materials needed:

Newspaper
Matches
Pan
Sand

Procedure: Show students a mixture of sand and sugar or iron filings and salt, etc. Have them guess what substances are present in these mixtures by looking at them. How can they tell? Show students a glass of water. Can they guess by looking at the water what substances are present? (The clear water is the combination of two gases, oxygen and hydrogen.) Show the students a lump of sugar. Can they guess by the appearance of the sugar what elements are present? (Take the two colorless and tasteless gases that combine to make water, combine them with carbon, and sweet, solid sugar will be formed.) Explain that in a compound, unlike a mixture, it is almost impossible to tell what elements are present merely from appearance.

Explain that sugar and water are results of chemical changes. Chemical change occurs whenever a compound is formed or decomposed. Signs of chemical change include:

1. the formation of a gas,
2. the formation of a new solid material or a precipitate,
3. color change,
4. temperature change,
5. odor change,
6. texture change,
7. change in magnetic prpoerties,
8. change in electrical conductivity, etc.

Burn a piece of newspaper (in a dish or pan containing a layer of sand) to produce smoke, ashes, charred fragments plus heat and light as an example of chemical change. Have the students compare this material with pieces of unburned torn newspaper. What differences do they notice between the burned paper and the torn paper? (Color, texture, odor, etc.) Which is a physical change and which is a chemical change? How do they know?

#

CHEMISTRY

ACTIVITY 17

1. **List the physical properties you observe in the torn newspaper.**

2. **List the physical properties you observe in the burned pieces of newspaper.**

3. **List the "signs of chemical change" you observed during this activity.**

CHEMISTRY

ACTIVITY 18

Purpose: To have the students observe how two elements, iron and oxygen, can combine to form a compound (red iron oxide).

Materials needed:

2 steel wool pads (not soaped)
3 glass dishes
3 tall jars (all the same size)

Procedure: Review with students the meanings of element, mixture, and compound. Review meanings of physical and chemical changes.

Have the students wet a pad of steel wool and place it in the bottom of a tall jar so that it will hold its place when the jar is inverted. Place the jar, inverted, in a dish of water

Have the students place a steel wool pad in the bottom of a second jar so that it will hold its place when the jar is inverted. Invert this jar and place it in a dish with no water.

Invert the third jar (containing no steel wool pad) in a dish of water.

The first jar with the moist steel wool pad and the water serves as the experiment. The other two serve as controls.

Have each student make three diagrams, one of the experiment and one of each of the controls. Have them label the materials used in the experiment and the controls.

Have the students observe and compare the jars over a period of a week. Have each student make a diagram of the experiment and the controls after one week. Label as before.

The water should rise in the jar containing the steel wool and placed over the water as the oxygen inside of the jar combines with the iron in the steel wool to form rust. (The higher air pressure on the outside of the jar pushes down on the water and forces some of it, about 1/5 or the proportion of oxygen in the air, to rise up into the jar.) The pad in the control jar should remain unchanged. The water level in the other control jar should not rise.

#

CHEMISTRY

ACTIVITY 18

Purpose: To observe how two elements, iron and oxygen, can combine to form a compound, red iron oxide.

Materials needed:

Procedure:

STEEL WOOL PLUS WATER	STEEL WOOL, NO WATER	WATER ONLY, NO STEEL WOOL

Results:

STEEL WOOL PLUS WATER	STEEL WOOL, NO WATER	WATER ONLY, NO STEEL WOOL

Conclusions:

CHEMISTRY

ACTIVITY 19

Purpose: To show the students one way chemical change is used in the home.

Materials needed:

Food coloring
Water
½ cup measuring cup
4 glasses of the same size
Chlorox
Eyedroppers or straws
Stirrers

Procedure: Have students put several drops of food coloring into a glass half filled with water. Stir. Have them add a drop of Chlorox at a time. Stir after each drop. Discuss what happens. (The liquid rapidly looses its color and becomes almost colorless.) Discuss what signs were noticed that suggest a chemical change has taken place. Explain that the dye in the food coloring is oxidized to form compounds that are without color.

Have the students measure ½ cup of water into each of four glasses. (Be sure each glass is clean before you do this.) Have them put the same number of drops of food coloring into each glass. Use red, yellow, green, and blue food coloring.

Have the students hypothesize what will happen if they add the same amount of bleach, a few drops at a time, to each of the four glasses. Which color will bleach or "fade out" first? Second? Third? Last?

Have students add one or two drops of Chlorox at a time to each glass and stir. Have them tabulate their results on a chart.

Explain to students that in the past most bleaching of cloth was done by placing the cloth in the sun. The sun's rays faded out colors by making the dye compounds break down. Discuss why dark colored clothes should be hung in the shade to dry. Explain that oxidation or bleaching by chemicals is a process similar to sun bleaching.

#

CHEMISTRY

ACTIVITY 19

Purpose: To observe one way chemical change is used in the home.

Materials needed:

Procedure:

Results:

COLOR	NUMBER OF DROPS USED TO BLEACH OR "FADE OUT" COLOR
RED	
YELLOW	
BLUE	
GREEN	

Conclusions:

#

CHEMISTRY

ACTIVITY 20

Purpose: To show students one way chemical change is used in industry.

Materials needed:

Milk
Enameled pan
Electric hot plate
Vinegar

Procedure: Discuss ways industry uses chemical change to improve man's welfare. For example, man uses milk to make paint, glue, artifical wool and plastics. The material in milk which makes this possible is called CASEIN (ká se in).

Have a student pour a pint of milk in an enameled pan and heat it very gently. Remove the milk from the flames. Stirring constantly, pour in a half cup of vinegar. The mixture should curdle at once. Continue to stir until the white curd gathers together in the form of a rubbery mass. Lift the mass from the pan, squeeze out the water, and have the students examine the product. What signs of chemical change did they note?

Explain to the students that when the chemist wishes to make articles of casein like those mentioned above, he must first remove the casein from the milk as was done in the experiment above. After he removes this curd, he dries it. Then he grinds it to a powder, adds water and coloring matter, and kneads it into a dough. Then he presses the mixture into a heated mold to give it the shape of the desired article. He hardens it by dipping it into a chemical solution. Discuss the different kinds of plastic the students are familiar with. Some of them are transparent.

#

CHEMISTRY

ACTIVITY 20

Purpose: To learn one of the ways industry uses chemical change.

Materials needed:

Procedure:

Results: (List the signs of chemical change that you noted during the experiment.)

Explain in your own words how industry uses chemical change to improve man's welfare.

CHEMISTRY

ACTIVITY 21

Purpose: To show students how to test materials for the presence of starch.

Materials needed:

Tincture of iodine
Cornstarch
2 glasses
Water

Procedure: Explain to students that this experiment is their introduction to two useful chemicals--IODINE and STARCH. Iodine is an element, (chemical symbol "I"). It is a nonmetallic chemical element of atomic number 53. Iodine is described as being dense, lustrous, bluish-black, crystalline solid. Starch is a compound of carbon, oxygen and hydrogen. It is found in plants.

Have students fill each of two glasses with the same amount of water. Add a teaspoon of cornstarch to one of the jars. Stir. Add a few drops of tincture of iodine to each jar. Stir. What happens? (The starch solution turns dark blue, the other does not.) Explain to students that chemists use this color as a test to tell if starch is present in a material. Have students use the jar containing the dark-blue solution as a comparison when testing other materials for starch.

IODINE TESTS SHOW THAT THERE IS

STARCH IN THESE	NO STARCH IN THESE
POTATO	LARD
APPLE	BUTTER
OATMEAL	EGG WHITE
FLOUR	SUGAR
BEAN COTYLEDON	LETTUCE LEAF

#

CHEMISTRY

ACTIVITY 21

Purpose: To become familiar with the test used to detect starch in materials.

Materials needed:

Procedure:

Results:

Now test the following materials for the presence of starch.

MATERIAL	RESULTS
POTATO	
APPLE	
SUGAR	
OATMEAL	
LARD	
BUTTER	
EGG WHITE	
LETTUCE LEAF	
FLOUR	
BEAN COTYLEDON	

CHEMISTRY

ACTIVITY 22

Purpose: To show students that in strong sunlight green leaves produce starch.

Materials needed:

- Sun
- A vigorous plant
- Medicine dropper
- Paper clips
- Dark paper or aluminum foil
- Electric hot plate
- Alcohol
- Water
- Tincture of iodine
- A piece of glass or tile

Procedure: Explain to students that the most important chemical process in the world is the making of starch and sugar by plants. This process is called PHOTOSYNTHESIS which comes from the Greek word PHOTOS, meaning LIGHT, and SYNTHESIS, which means PUTTING TOGETHER. In photosynthesis, carbon dioxide and water are put together to make sugar and starch, using energy from light. The following equation shows what happens during this process.

$$CO_2 + 2H_2O \xrightarrow[\text{chloroplast}]{\text{light}} CH_2 + O_2 + H_2O$$

CARBON DIOXIDE PLUS WATER WITH THE HELP OF THE LIGHT FROM THE SUN AND THE CHLOROPLAST OR GREEN PLANT BODIES FOUND IN LEAF CELLS COMBINE TO PRODUCE STARCH OR SUGAR PLUS OXYGEN PLUS WATER.

Point out that the equation is balanced. There are equal numbers of the same atoms on each side of the arrow. Notice that in photosynthesis water is used as well as produced.

Explain that a simple experiment can show us that plants do produce starch. Ask students how they think a leaf can be tested to see if it contains starch. (Iodine test.) Explain that because the green color or chlorophyll in a leaf would hide the test, the chlorophyll must be removed before the leaf can be tested for starch.

Explain that it is easy to remove chlorophyll from a leaf. Heat some alcohol in a jar over boiling water until it boils. Break several green leaves from a vigorous geranium plant or a young bean plant (which have been standing in strong sunlight for five or six hours just before the test is made) and place them in the boiling alcohol until the chlorophyll has been removed. Quickly remove the leaves from the alcohol and put them in a basin of hot water. Remove a leaf from the water and spread it out on a piece of glass or tile. Add a few drops of tincture of iodine and leave for several minutes. If the sugar in the leaf has turned to starch, you will get a positive test. (The color will turn deep blue.)

For a variation of this test, early in the morning have the students cover one leaflet of the plant with dark paper or aluminum foil. Leave a square pattern cut out of the middle. Fasten it to the leaflet with paper clips. Keep the plant in strong sunlight for five to six hours. Then make the test for starch as above. Be sure to put iodine all over the leaf. The square exposed to light will turn dark blue if the plant has been able to make starch that day.

Discuss why the making of starch and sugar by plants is so important to man. (Provides us with food, directly or indirectly.)

#

CHEMISTRY

ACTIVITY 22

Purpose: To show that green leaves produce starch in strong light.

Materials needed:

Procedure:

Results:

Conclusion:

CHEMISTRY

ACTIVITY 23

Purpose: To show students that in strong light green leaves release water.

Materials needed:

2 pots of soil, one containing a plant
Cardboard, heavy wax paper, or aluminum foil
2 glass tumblers
The sun

Procedure: Explain to students that leaves have tiny openings called stomates (word means little mouthes) through which carbon dioxide can enter and water and oxygen can escape. To show that water does escape through the leaves of the plant, try this experiment. Use two similar pots of soil, one with a small plant and one without. After watering both, cover the soil in each pot with cardboard, heavy wax paper, or aluminum foil so none of the moisture can escape. (You can cut a slit in the covering, then tape it.) Invert glass tumblers or jars over each pot. Fasten the glasses so they will not fall over and set them in the sun. (The pot without the plant is your control.) Examine the pots from time to time during the day. Moisture should collect in drops on the side of the glass jar containing the plant, but not on the other jar. The plant is giving out moisture through the stomates in its leaves.

#

CHEMISTRY

ACTIVITY 23

Purpose: To show that in strong light green leaves release water.

Materials needed:

Procedure:

Results:

Conclusion:

ACTIVITY 24

Purpose: To show students that in strong light green leaves release oxygen.

Materials needed:

Water
Water weed (Elodea) or Coleus rooted in water
Glass funnel
Glass beaker
Test tube
Splint
Matches

Procedure: Place some water weed or Coleus under a funnel in a beaker of water. Invert a test tube full of water over the tube of the funnel. Leave the appratus in strong sunlight. Bubbles of gas should be liberated from the plant and rise to the top of the test tube. When enough oxygen has collected at the end of the tube, the test tube can be removed and the gas tested with a glowing splint.

Discuss why the releasing of oxygen by plants is so important to man. (Plants release oxygen to the air. Early life had to get along without free oxygen because oxygen atoms were tied up in water, rocks, and sand. Such organisms still live in the mud of waters.)

#

CHEMISTRY

ACTIVITY 24

Purpose: To show that in strong light green leaves release oxygen.

Materials needed:

Procedure:

Results:

Conclusion:

CHEMISTRY

ACTIVITY 25

Purpose: To show students that carbon dioxide is exhaled in breathing.

Materials needed:

Limewater
Soda straws
Paper cups or test tubes

Procedure: Explain to students that compounds have specific properties that can be indentified. Discuss the experiments in which students used iodine to identify the presence of starch. Explain that when carbon dioxide (a compound) is mixed with limewater, a milky substance appears and settles to the bottom. (This is the compound calcium carbonate or precepitated chalk.) Carbon dioxide is the only odorless and colorless gas that produces this result. Limewater, therefore, can be used as a test to identify the presence of carbon dioxide.

Provide each student with straws and small cups or test tubes that contain about 2 teaspoons of limewater. (Limewater is harmless if swallowed.) Have students blow bubbles gently through the limewater. What changes do they see in the liquid? (If the milky appearance disappears, it is due to an excess of carbon dioxide in the water which forms carbonic acid, which dissolves the chalk.)

Discuss the importance of man releasing carbon dioxide into the atmosphere.

#

CHEMISTRY

ACTIVITY 25

Purpose: To show that carbon dioxide is exhaled in breathing.

Materials needed:

Procedure:

Results:

Conclusion:

CHEMISTRY

ACTIVITY 26

Purpose: To help students understand the function and relationship of plants and animals in the cycling of oxygen and carbon dioxide in the atmosphere.

Materials needed:

Paper
Colored pencils or crayons

Procedure: Have students take notes to answer the following questions. Then have them use the information in a drawing of the oxygen cycle.

1. What happens to the carbon dioxide released by animals (including man)?

   Plants may absorb it in the process of photosynthesis.

2. How do green plants use carbon dioxide?

   Green plants use carbon dioxide in the process of photosynthesis.

3. What gas is given off by green plants in the presence of light?

   Oxygen.

4. What happens to the oxygen given off by green plants?

   Some is used by living forms in respiration.

5. What has prevented us from using up all of our oxygen supply on earth?

   It is replenished continuously by green plants.

#

CHEMISTRY

ACTIVITY 27

Purpose: To review concepts learned in previous activities.

Assignment:

Read: Probing into Science, pages 115-142

After reading the material listed above, take notes to answer the following questions. Be prepared to discuss your answers in class.

Questions:

1. What is meant by a chemical change?

2. List three chemical changes you have seen take place.

3. How does a chemical change differ from a physical change?

4. What three things are needed for burning to take place?

5. List some examples of slow oxidation.

6. What is a compound?

7. List two compounds.

8. How does a compound differ from a mixture?

CHEMISTRY

ACTIVITY 27 (page 2)

9. List two common mixtures.

10. In what ways can mixtures be separated into the different substances of which they are made?

11. Why are chemical changes important to man?

12. Explain why photosynthesis is considered the most important chemical process in the world?

ON-GOING ACTIVITIES

1. Make models of molecules. For atoms use plastic clay, sponge rubber balls, pop-it-beads, gum drops, jelly beans, Tinker Toy disks, and styrofoam balls.
2. Study electricity in relation to matter.
3. Make a report on Plasma, the fourth state of matter.

#

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THE SUN

OBJECTIVES

The student will be able to explain in his own words and to demonstrate through class activities that he understands:

1. Living things are either directly or indirectly dependent on the sun for their existence.
2. Living things adapt to their climate.
3. Many changes that occur in nature are directly related to the varying amounts of heat the environment receives from the sun.
4. Living things adapt to seasonal changes in diverse ways.

THE SUN

ASSIGNMENT

As we study the sun and the ways it is related to life on earth, take notes to answer the following questions. Later, when our discussions and activities are finished, you will use these notes to write a report on how the sun affects life on earth.

1. Read about the ways our sun affects our earth. Then list as many ways as you can think of that tell what would happen to our earth if our sun disappeared.

2. What is the sun made of?

3. Where does the sun get its heat?

4. How does the heat energy from the sun help to distribute water to all living things?

5. How does the heat energy from the sun help to form soil?

6. How does the energy from the sun help to produce the food we eat?

7. What does the word PHOTOSYNTHESIS mean?

8. Why is the name PHOTOSYNTHESIS a good name for the whole process of food making?

9. Explain why green plants don't grow in caves.

10. Describe how energy travels from the sun to an unborn colt.

11. Explain why the temperature is higher along the equator than it is at either the north pole or the south pole.

12. Explain what causes our seasons in Wisconsin.

13. Why do desert plants have thick "skins" and few or no leaves?

14. Why do most desert animals spend their daytime in holes in the ground, under rocks or in the shade of desert plants then, come out at night to feed?

15. How does the polar bear, living in the land of ice and snow, protect itself?

16. List as many changes as you can think of that occur in nature as dark follows daylight. (Can you explain these changes?)

17. List as many changes as you can think of that occur in nature as seasons change.

THE SUN

ACTIVITIES

1. Make a diorama, a bulletin board display, a mural, a set of pictures, etc. that shows the sun and the ways it affects the earth.

   a. Show the composition of the sun using chemical symbols of its most common elements.

hydrogen	H
helium	He
calcium	Ca
sodium	Na
magnesium	Mg
iron	Fe

   b. Show how the atoms of hydrogen unite to form one atom of helium plus light and heat energy. (See activity 2.)

   c. Show how this light and heat energy is used by green plants to make food.

   d. Construct one or more food chains using the green plant as the first link in any food chain. (Don't forget man!)

   e. Include a diagram of the water cycle showing its relationship to the sun.

   f. Show the way the sun helps to break up rock as a first step in the making of soil.

2. Demonstrate the way hydrogen atoms unite to form helium atoms plus energy. Start with four small balls of clay. Combine the four small balls into one large one reserving a small amount of clay as the "leftover" mass that changes to energy.

   This demonstrates fusion: lighweight atoms combine to form heavier atoms and energy.

element	atomic weight
H	1.00797
He	4.0026

   $$\begin{array}{rl} 1.00797 & \text{H} \\ \times\ 4 & \\ \hline 4.03188 & \\ -4.00260 & \text{He} \\ \hline .02928 & \text{leftover mass} \end{array}$$

3. Demonstrate the manner in which the earth makes its yearly orbit around the sun. Place a lamp in the center of the floor to represent the sun. Draw a chalk circle around the lamp to represent the earth's orbit. Have several children take turns carrying the world globe around the circle making sure the axis of the globe points in the direction of the North Star at all times. Have the children stop at each change of season (mark these on the chalk line) for a discussion of where the direct rays from the sun strike the globe at that point, as related to our hemisphere. Also rotate the globe at each stopping point to illustrate changes that occur from day to night.

4. Use the six pictures that appear on the top of the Audubon Ecology Chart to develop the understanding that the varying amounts of heat we get from the sun helps to determine how and where plants live. (See The Story of Ecology Teachers' Guide.)

ON-GOING ACTIVITIES

1. Use the six pictures that appear at the top of the Audubon Ecology Chart to motivate study on the adaptions of living things to their climit. Teams can be assigned to study the six areas.

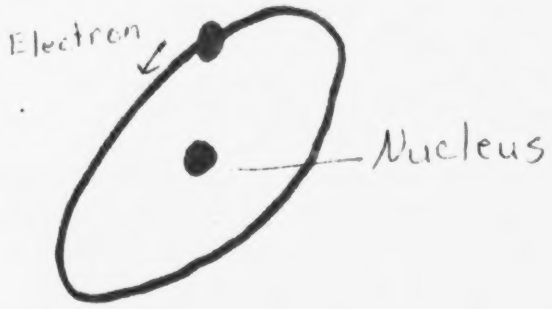
2. Make a chart showing length of shadows cast by the sun's rays on a small tree growing out in the open. On the chart note the time of day, the length of the shadow, the temperature, and the effects of the sun's rays on plants and animals near-by. (See The Story of Ecology for Audubon Juniors, pages 7-9.)

3. Make a sunset mural to show how the seasons change. (See The Story of Ecology for Audubon Juniors, pages 7-9.)

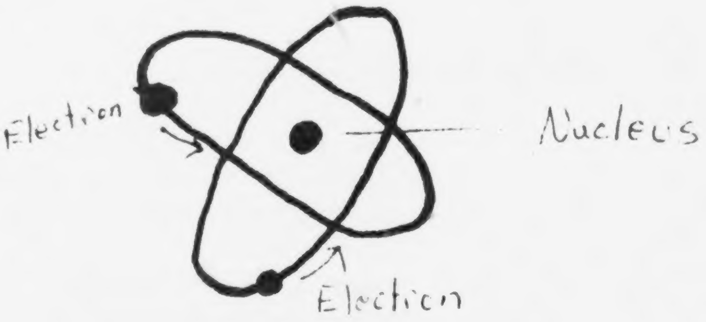
4. Study how solar energy is used by man today and how solar energy might be used by man in the future. (See attached sheet.)

THE SUN

The sun is like a big atomic furnace that turns mass into energy. It changes 657 million tons of hydrogen into 653 million tons of helium every second. The missing 4 million tons of mass are given off into space as energy. The sun's radiant energy comes from nuclear fusion This means that the nuclei from hydrogen atoms unite or fuse together to form a new atom--helium. The light weight atoms of hydrogen do this under conditions of great heat. Below are drawings showing how scientists portray hydrogen and helium atoms.



Hydrogen Atom



Helium Atom

Our earth receives only a very small part of the sun's energy which is given off into space.

People used to worry that the sun might wear out. Now scientists think the sun will last for 10 to 30 billion years--or maybe forever.

How is solar energy used by man today?

How do you think solar energy will be used by man in the future?

THE SUN

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AIR

BEHAVIORAL OBJECTIVES:

The child can explain in his own words and demonstrate through classroom activities that he understands the following:

1. The characteristics that make up the diversified nature of air.
2. The interrelationship of air and living things.
3. The manner in which air can be adapted to accomodate the interests of man.
4. The dependence of the constituency of air upon how our atmosphere is used.

Air-1 **Air** Name______________________________

I. What do we know about air? Let's list the things we think we know.

II. We have listed the things which we believe to be true about air. The following experiments will help us decide whether or not we are right.

We cannot see air. Is it real?

HYPOTHESIS:______________________________

EXPERIMENT A. (You may do this experiment or think of one of your own.)

MATERIALS NEEDED: Balloons

PROCEDURE: Blow your balloon up. Pinch it.

RESULTS:______________________________

____

CONCLUSIONS:______________________________

____

____

____

We cannot see air, but we know that it is real. Is it actually all around us? Does it take up space?

HYPOTHESIS:

EXPERIMENT B: (You may do this experiment or think of one or your own.)

MATERIALS NEEDED: Glass bowl. Glass. Water.

PROCEDURE: Turn a glass upside down. Lower it into a glass bowl partially filled with water.

RESULTS:

CONCLUSIONS:

We know that air is real, that it is all around us, and that it takes up space. Does air have weight?

HYPOTHESIS:

EXPERIMENT C. (You may do this experiment or think of one of your own.)

MATERIALS NEEDED: Five ballons. Paper bag. Tie. Scale.
OR Inflatable ball. Scale.

PROCEDURE: Weigh the empty balloons and bag OR weigh the empty ball. Blow up the balloons, place in the bag, and weigh all OR inflate the ball and weigh it.

RESULTS:

CONCLUSIONS:

Air-3

We know that air is real, that it is all around us, that it takes up space, and that it has weight. Does air have pressure?

HYPOTHESIS:

EXPERIMENT D. (You may do this experiment or think of one of your own.)

PART I

MATERIALS NEEDED: Balloons.

PROCEDURE: Blow up your balloon. Press on it.

RESULTS:

CONCLUSIONS:

PART II

MATERIALS NEEDED: Glass. Water. Piece of cardboard. Pan.

PROCEDURE: Fill a glass with water. Place a piece of cardboard on top of the glass. Hold the glass over a pan. Turn the glass upside down.

RESULTS:

CONCLUSIONS:

We know that air is real, that it is all around us, that it takes up space, that it has weight, and that it has pressure. Can air be compressed? Is this important?

HYPOTHESIS:

EXPERIMENT E. (You may do this experiment or think of one of your own.)

MATERIALS NEEDED: Large balloon. Book.

PROCEDURE: Put a book on top of your balloon. Blow up the balloon.

RESULTS:

(EXPERIMENT E continued)

CONCLUSIONS: ____

____

____

READ PAGES 80-83 IN SCIENCE IN YOUR LIFE to see what other people say about air. List some things found in your home which use air pressure to do work for you. ____

____

____

THINGS TO THINK ABOUT :

We know that air is ___________, that it is all ___________ us, that it takes up ___________, that it has ___________, that it has ___________, and that it can be ___________.

We know that air is matter and that it exists in a ___________ state. Because air exists in a gaseous state its molecules are ___________ ___________. This is why we cannot see air.

We know that air moves. Can you give two examples to prove it?

____

____

Air does not have any shape. It takes the shape of its container. Can you give an example that shows this?

____

All of these things may be called the physical characteristics or the physical properties of air.

PART III

We have studied the physical characteristics of air. Let's see if we can find out what makes up air. We will see what the chemical composition of air is. Air is a mixture of gases. Each gas found in air exists in its own molecular form.

A. Make a drawing of the gases in air. (See page 74 of Science In Your Life.)

B. Air can be composed of varying amounts of different gases, depending on where you find the air. Can you explain why?

____

____

____

____

____

____

C. See if you can find the different gases which usually make up air and complete the following chart.

COMPONENTS OF AIR

GAS	CHEMICAL SYMBOL	AMOUNT IN AIR	WHERE THIS GAS COMES FROM IN THE FIRST PLACE	USE WHICH HAS BEEN FOUND FOR THIS GAS

D. Photosynthesis is a very important plant process. Explain what it is. Explain how it affects you.

E. Look up "breathing." (A health book might be a good place to look.) How is air used by the body.

F. Why is nitrogen important to animals? ____________________

See if you can describe the nitrogen cycle. ______________

G. Sometimes gases other than those you listed on your chart get into the air. When this happens, we say that the air is ____________.

One such gas is carbon monoxide (CO). See what you can find out about it. Why is it a problem?

PART IV

We have learned about the physical properties of air. We have looked at the chemical composition of air. We have discussed the problem of air pollution. As a review, draw a diagram showing the different parts of the atmosphere and locate the part which contains our air.

Do all planets have atmospheres? ______________________________

Are there atmospheres not usable by man? __________________________

____

Why is the troposphere so important to us? _________________________

____

____

What must we do to keep our troposphere free of pollution so that our atmosphere will be preserved in a good, usable condition for a long time?

____

____

____

____

____

____

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LIVING THINGS IN THE FOREST

BEHAVIORAL OBJECTIVES:

The child will be able to explain in his own words and demonstrate through classroom activities that he understands the following:

Our forest community contains a vast variety of living and non-living things.

These living and non-living things depend upon each other.

There is constant change within the forest which contributes to this interdependence.

Living things within the forest must adapt to their environment for survival.

LIVING THINGS IN THE FOREST

I. Slide Talk

path leading into the forest 1	As you enter a forest, it appears very quiet and still. But should you stop - look - and listen, it wouldn't be long before you would realize that the forest is full of life and very active. What you see and hear is only a small part of that community, composed of millions of living things - in the ground, on the ground, in the air, and among the leaves and branches. Some examples of this life are:
	... a squirrel,
squirrel 2	
	... an insect,
insect 3	
	... and a raccoon.
raccoon 4	
aerial view of Elvehjem 5	A forest community can be compared to the community we live in. We are members of a community because of where we live. We are also members of a community because of our interrelated activities in our school. A forest is a community because of the plants and animals that live there and because of their interrelated activity.

group of children in forest 6	Here is an example of a school community and a forest community working together.
forest (summer view) 7	Many plants grow in the forest. The easiest plants to see are the trees. Therefore, we name forests after the trees that most commonly grow in them.
forest (fall view) 8	What is a tree? (A tree is a woody plant, twelve feet or more tall with a single main stem, or trunk, and a more or less distinct crown of leaves.)
forest (winter view) 9	You will be learning about living things in a forest like you have at the Madison School Forest. Before you can begin learning about the forest community you will want to find out what kinds of trees make up our forest.
coniferous trees 10	There are two groups of trees - coniferous...
deciduous trees 11	and deciduous (flowering). Can you find some differences between these two? (You may want to go back to previous slide.) Now do you know which group of trees are characteristic of our forest? (Deciduous)
oak leaf on the ground 12	Remembering what you have seen and learned at the school forest, what is the name of the forest you'll be learning about? (Oak Forest)
close-up view of all forest layers 13	A close-up of a deciduous forest shows that it, too, is a community of plants and animals living together, with plant life forming the foundation. Because the forest is so vast, with so much life above and about, we must select only a segment of the forest community at a time, to see how life there adapts to and changes with the surroundings. How many different layers are you able to see here? We will also discover the diversity and interrelationships of all living things in this community.

THE END

II. Three Layers of Green - Slide Talk

III. Forest Layers

A. Canopy

1. What is the canopy?

2. A canopy can be opened or closed.

   What do you think is meant by this?

   Do you think this would make a difference as to what kinds of living things are living below? Explain.

3. What are some of the characteristics of the canopy?

4. Why is the canopy so responsible for providing food for the forest? Explain.

5. Do you think many animals inhabit the canopy? Why or why not?

B. Understory -

1. Can you guess why this layer is called the understory?

2. What makes the understory different from the canopy?

3. Who inhabits this forest layer?

4. What makes this a better home than the canopy for many of our forest residents?

C. Shrub Layer

1. What is a shrub?

2. What are some characteristics of shrubs?

3. In what way do shrubs contribute to the forest community?

D. Herb Layer

1. Definition (in your own words).

2. What are some examples of forest herbs?

3. In what season is the herb layer most noticeable?
   Why do you think this is so?

4. In what ways might the plants and animals depend upon each other in this layer?

5. What makes this a good habitat within the forest community?

What animals would take advantage of this segment of the forest community? Why?

E. Forest Floor

1. What is another name for the forest floor? How do you think it got this name?

2. How does the forest floor depend on the other layers of the forest?

3. Does the forest floor help the other forest layers? If so, in what ways?

4. Is there much life in and on the floor of the forest? Tell what you can about the life here.

5. How do the living and the dead depend upon each other on the forest floor?

IV. Life in the Forest

A. Required Reports: Show how animals and plants in a forest community live together and depend on each other.

1. Select an interesting forest plant (tree, shrub, flower...) and find out as much as you can about it. Some questions to ask yourself are:
    - a. What does it look like?
    - b. Where does it grow in the forest?
    - c. In what layer or layers of the forest can your plant be found?
    - d. Show the parts of a plant.

After you have studied your plant, begin a classroom mural on the forest community. Place examples of your plant in the proper layer or layers.

2. As you study your favorite forest animal be sure to include as much as you can about it. These phrases may help you find some interesting information about your animal:

Animal Tools
Animal Homes
Animal Teeth
Animal Tails
Animal Tracks
Animal Appetites
Animal Clothing
Animal Weapons
Animal Baggage
Animal Sounds

Here are some questions to guide you in your report. You may not want to use all of them, and you may want to add some of your own.

a. Is your animal an insect, mammal, bird, or something else?

b. How does your animal reproduce?

How many?

How often?

When?

c. In what layer of the forest does your animal live?

How many other layers does it visit or use?

How does it use these other layers?

d. List as many ways as you can how your animal moves from place to place.

e. Does your animal need anything outside the forest? Explain.

f. Does your animal influence anything outside the forest?

g. How is your animal adapted to forest life? Discuss body structure.

h. What does your animal use from the forest?

i. What does your animal do for the forest?

j. Could your animal survive in an open field habitat? Include the following in your answer:

(1) food

(2) shelter

(3) protection

k. How does your animal protect himself?

l. How does your animal prepare for winter?

After you have studied your animal, add it to your classroom's forest mural.

B. On-going Activities: After studying your favorite forest plant and animal, look through the following topics. Pick one that you would like to explore and research it as completely as you possibly can. You aren't limited to just these ideas. If you are interested in something about the forest that isn't listed here, ask your teacher about it. Remember: Reports are always more interesting and exciting if you add a little extra flavor to them through some creative project. These reports can be worked on in teams or by individuals.

1. Describe the forest as an apartment house or hotel.
   How do you think these many layers are beneficial to the many inhabitants (both plant and animal) who live there?
2. As you studied food chains, you learned about photosynthesis. Tell as much as you can about:

   a. the transfer of energy
   b. the pyramid of energy.

   Use the following terms in your report:
   a. plants
   b. herbivores
   c. carnivores
3. Many things influence the balance of nature. Some of these "limiting factors" of nature are:
   a. weather
   b. animals higher in pyramid

c. disease

d. starvation

e. competition (for food or space – or both)

Show how these "limiting factors" of nature help to regulate the balance of nature.

4. Show that plant and animal life is constantly changing in a forest community. One of the following titles may help you organize your ideas:

a. Life-death cycle

b. Matter recycling

c. Energy transfer

d. Succession

A chart representing your report will make this more interesting to others.

5. Consider the seasons of the forest and tell how the seasonal **changes will affect** the canopy.

a. What will take place in the forest canopy during the four seasons?

b. Will this change in seasons cause a change in who and what lives there?

c. Will this seasonal change also cause a change in who and what lives in the lower layers?

d. How will the animals adapt to change?

e. How will the plants adapt to change?

f. How will each of these depend upon the other during these changes?

g. Pretend that you can take away any one important thing that helps make the canopy what it is. (Examples: sun, plants, animals, soil, water.) What would happen? Can the canopy get along without any one of these important elements? (Show interrelationship)

6. Pick any other forest layer and answer the questions for number six. You will be showing how the seasonal changes will affect your forest layer.

7. There are some great threats to the forest. Some are caused by nature; some are caused by man. See what you can find out about the forest threats. How do each of these threats affect forest life? What can be done to prevent the threats?

8. What role does each one of the following people play in guarding our forest life against destruction? As an activity, set up a panel to discuss the role each of these people plays.

   a. Forester

   b. Wildlife Manager

   c. Law Enforcer

   d. Conservation Groups

   e. Ecologists

   WHAT CAN YOU DO?

9. What can you find out about TREES?
   a. What are the characteristics of a tree?
   b. What kind of trees do we have in our woods? (set up identification system: bark, branching system, leaves, buds, etc.)
   c. Why are the leaves of a tree important to a forest?
   d. What would happen to a tree that is stripped of its leaves?
   e. Why is bark important to a tree?
   f. What happens to a tree if all the bark is removed?
   g. How many ways is a tree important to a forest?
   h. Examine a green leaf under a microscope. Diagram and explain the various parts of the leaf, as well as its pipeline system and its petiole.
   i. Which has more branches, the crown of a tree or the root system?
   j. Compare the branches of a tree with the veins of a leaf. How do these veins help the growth of the tree?
   k. Dissect several seeds to discover the three main parts of a seed.
   l. How do trees breath?
10. Select one of the following examples of forest life that you have not already studied and see what you can find out about it.
   a. lichens
   b. mosses
   c. plant galls
   d. ferns
   e. spring wild flowers
   f. seeds

11. Make a chart illustrating a side-view of the life in the forest. Where is your plant? Your animal?

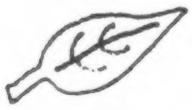
12. Plan a TV program. Produce a program showing the many ways that plants provide shelter and food for the forest wildlife. Tell about the importance of each home to its inhabitants.

13. Prepare a bulletin board which will assist in identification of woody plants.

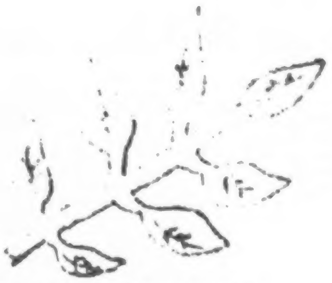
    SUGGESTION:

    WAYS TO IDENTIFY WOODY PLANTS

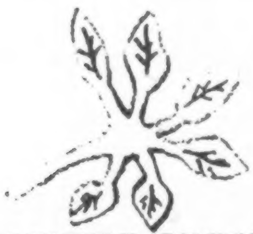
    LEAVES CAN BE SIMPLE
    OR COMPOUND:



SIMPLE LEAF



PINNATELY COMPOUND
LEAF



PALMATELY COMPOUND
LEAF

14. Prepare a bulletin board which shows the main parts of a flower: petals, sepals, pistil, and stamens. In discussion the bulletin board can be further utilized in showing how flower parts are adapted to insect lure and pollination.

FOREST FOOD CHAIN

Every plant and animal is important in nature. To live and grow, each needs food, water and room. By feeing on one another and competing for available food and space, increases in population are held in check and a state of balance results between the species in a community. This is the Balance of Nature.

All plants and animals listed here are links in the chain of food relationships in the forest. The series of numbers below each animal indicates its principal foods. These numbers refer to eggs, young and adults.

1. Bark
2. Nuts
3. Grass
4. Seeds
5. Fungi
6. Leaves
7. Herbs
8. Ferns
9. Fruit
10. Buds, Twigs
11. Porcupines
    1. bark
    2. nuts
    6. leaves
    7. herbs
    9. fruit
    10. buds, twigs
12. Rabbits
    1. bark
    3. grass
    7. herbs
    9. fruit
    10. buds, twigs
13. Deer
    2. nuts
    10. buds, twigs
14. Earthworms
    3. grass
    6. leaves
    7. herbs
    10. decaying matter
15. Millipeds
    3. grass
    7. herbs
    10. decaying plants

16. Insects (plant-eating)
    1. bark
    10. buds, twigs

17. Twig-feeding birds

    4. seeds
    16. insects (plant-eating)
    25. spiders
    30. insects (preying)

18. Squirrels

    1. bark
    2. nuts
    4. seeds
    5. fungi
    6. leaves
    7. herbs
    8. ferns
    9. fruit
    10. buds, twigs
    17. twig-feeding birds
    22. ground-feeding birds
    23. leaf-feeding birds
    24. trunk-feeding birds

19. Moles

    4. seeds
    7. herbs
    14. earthworms
    15. millipeds
    16. insects (plant-eating)
    25. spiders
    26. centipedes
    30. insects (preying)

20. Mice
    2. nuts
    4. seeds
    7. herbs
    9. fruit
    15. millipeds
    16. insects (plant-eating)
    25. spiders
    26. centipedes
    30. insects (preying)

21. Turtles

    4. seeds
    5. fungi
    6. leaves
    9. fruit
    14. earthworms
    16. insects (plant-eating)
    30. insects (preying)

22. Ground-feeding birds

    2. nuts
    4. seeds
    9. fruit
    10. buds, twigs
    14. earthworms
    15. millipeds
    16. insects (plant-eating)
    25. spiders
    26. centipedes
    30. insects (preying)

23. Leaf-feeding birds

    4. seeds
    16. insects (plant-eating)
    25. spiders
    30. insects (preying)

24. Trunk-feeding birds

    2. nuts
    4. seeds
    16. insects (plant-eating)
    25. spiders
    30. insects (preying)

25. Spiders

    15. millipeds
    16. insects (plant-eating)
    26. centipedes
    30. insects (preying)

26. Centipedes

16. insects (plant-eating)
30. insects (preying)

27. Shrews

2. nuts
4. seeds
7. herbs
9. fruit
14. earthworms
15. millipeds
16. insects (plant-eating)
19. moles
20. mice
25. spiders
26. centipedes
27. shrews
28. snakes
29. frogs, toads
30. insects (preying)

28. Snakes

14. earthworms
16. insects (plant-eating)
17. twig-feeding birds
19. moles
20. mice
22. ground-feeding birds
23. leaf-feeding birds
24. trunk-feeding birds
25. spiders
26. centipedes
27. shrews
28. snakes
29. frogs, toads
30. insects (preying)

29. Frogs, Toads

14. earthworms
15. millipeds
16. insects (plant-eating)
25. spiders
26. centipedes
30. insects (preying)

30. Insects (preying)

15. millipeds
16. insects (plant-eating)
25. spiders
26. centipedes
29. frogs, toads
30. insects (preying)

31. Owls

12. rabbits
16. insects (plant-eating)
17. twig-feeding birds
18. squirrels
19. moles
20. mice
22. leaf-feeding birds
23. ground-feeding birds
24. trunk-feeding birds
27. shrews
30. insects (preying)
34. skunks
38. hawks

32. Bears

2. nuts
4. seeds
9. fruit
11. porcupines
12. rabbits
13. deer
16. insects (plant-eating)
20. mice
21. turtles
27. shrews
29. frogs, toads
30. insects (preying)

33. Raccoons

2. nuts
4. seeds
9. fruit
14. earthworms
16. insects (plant-eating)
19. moles
20. mice
21. turtles
27. shrews
29. frogs, toads
30. insects (preying)

34. Skunk

- 7. herbs
- 9. fruit
- 16. insects (plant-eating)
- 19. moles
- 20. mice
- 21. turtles
- 22. ground-feeding birds
- 25. spiders
- 26. centipedes
- 28. snakes
- 29. frogs, toads
- 30. insects (preying)

35. Foxes

- 9. fruit
- 11. porcupine
- 12. rabbits
- 13. deer
- 18. squirrels
- 20. mice
- 22. ground-feeding birds
- 27. shrews
- 28. snakes
- 29. frogs, toads
- 30. insects (preying)
- 34. skunks
- 37. opossums

36. Bobcats

- 11. porcupine
- 12. rabbits
- 16. insects (plant-eating)
- 17. twig-feeding birds
- 18. squirrels
- 20. mice
- 22. ground-feeding birds
- 24. trunk-feeding birds
- 27. shrews
- 31. owls
- 33. raccoons
- 34. skunks
- 37. opossums
- 38. hawks

37. Opossums

- 2. nuts
- 4. seeds
- 9. fruit
- 16. insects (plant-eating)
- 17. twig-feeding birds
- 22. ground-feeding birds
- 23. leaf-feeding birds
- 24. trunk-feeding birds
- 30. insects (preying)

38. Hawks

- 12. rabbits
- 16. insects (plant-eating)
- 17. twig-feeding birds
- 22. ground-feeding birds
- 23. leaf-feeding birds
- 24. trunk-feeding birds
- 27. shrew
- 28. snake
- 30. insects (preying)

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FIFTH GRADE

PLANT AND ANIMAL COMMUNITIES

GENERAL OBJECTIVES:

1. Each community has its characteristic forms of life.
2. Each community has a variety of plants and animals.
3. Each animal and plant in a community contributes something to that community.
4. The animals and plants in each community work towards maintaining a balance among themselves and with their environment.
5. Living things depend on each other and their environment.
6. Change is an important factor in each community.

PLANT AND ANIMAL COMMUNITITES

Introduction

Specific Objective:

Each student can recognize diversity and change by observing his own plot of ground at regular intervals and by recording what he finds there.

Activities:

1. Each student chooses a 1' by 1' plot of ground.
2. He makes a map of his plot, especially noting the position and height of the plants there.
3. He visits the plot regularly, recording the temperature, any changes in the plants, and the number and kinds of animals he finds there (see Tannenbaum's Ecology for more specific directions). Suggested duration of this activity is three weeks, and the plots can then be revisited during the different seasons. (Other students not involved in the activity enjoyed pulling up the stakes that marked the plots; however, this activity can be adapted to overcome this difficulty.)
4. The students' records are discussed in class and the students can do more research on the plants and animals they have observed.

Materials and Equipment:

1. Rulers
2. Thermometers
3. Magnifying lens (students need instruction in safety precautions while using magnifying lens outdoors)
4. Guide books (for identification of local plants, weeds, animals, insects, etc.)

Ongoing Activities:

The teacher let the students follow their interests, and the following activities are the results:

I. Weeds (most common plant on student plots)
   A. Generalizations
      1. Weeds are soil builders, preparing the soil for an advanced plant community.
      2. Weeds grow where the soil has been disturbed, where there is plenty of sunlight, and where there is little competition.
      3. Weeds have traveled far distances; most of our weeds came from Asia.
      4. Many of our common plants are weeds, such as corn and many of our garden flowers.
   B. Activities
      1. Give a classroom lecture, using samples of common weeds and pictures and slides as visual aids.
      2. Take nature walks to identify weeds and to recognize conditions for weed growth.
   C. Evaluation
      1. Each student can identify some common weeds, such as the dandelion, plantain, quack grass, and milkweed.
      2. The student can point out at least three conditions necessary for weed growth.
      3. Using his own words, the child can explain at least three reasons why weeds are important.

II. Seeds (the students noticed traveling seeds on their nature walks)
   A. Generalizations
      1. A seed is "a masterpiece of efficient design."
      2. Different seeds have their own requirements for nutrients, moisture, temperature, and air.
      3. Seeds can travel by barbs, by parachutes, by mechanical devices for scattering, by fruit passing through animal alimentary canals, and by wind and water.
      4. Seeds supply an abundance of food for man and animals.
   B. Activities
      1. Soak lima bean pods in water for a day. Students dissect the pods, draw pictures, and label the three parts of the seeds.
      2. Each student grows his own plant or plants (see attached sheet) keeping a record of the conditions needed for the best growth possible and the results when any of these conditions are altered.
      3. The class takes trips to an area around a pond, a marsh, and a forest in the fall to identify as many different seeds as possible and how they travel.
      4. The students do research on different seeds, reporting to the class what the seeds look like, how they travel, and how they are important to plants, man and/or animals.
   C. Evaluation
      1. The student can draw a picture of a seed, labeling the coat, cotyledon, and embryo.
      2. The student can give an example for at least three different ways seeds travel from place to place.
      3. The student can explain in his own words why it is necessary for some plants to produce so many seeds, e.g. ragweed, sunflower, etc.

III. Terrariums
  A. Generalizations
    1. Animals and plants interrelate with each other.
    2. Some animals are carnivores while others are herbivores.
    3. Green plants are the basic food producers and the first link in a simple food chain.
    4. The potential for growth can be present even though no plants are visible.
  B. Activities
    1. Have students set up a classroom terrarium, using plants from a wooded area near the school. After the plants begin to grow, a frog may be introduced into the terrarium.
    2. Other things may be introduced into the terrarium that may or may not affect change. (Our students brought flies for the frog to eat. Another student slipped in a grasshopper to see if the frog would eat it, but the grasshopper ate all the leaves from the plants. The students are still watching and watering the soil in the terrarium to see if there were any latent seeds present that will eventually grow.)
    3. During the winter have the students bring in a piece of frozen ground to see what kinds of dormant life might emerge.
    4. Have the students do research and then construct simple food chains out of construction paper. Each step in the chain can be shaped like a link, and when the chains are finished, the students can experiment with trying to link them all together. This activity of trying to link the chains together will help the students to synthesize what they have learned about interrelationships in nature and to appreciate the complexity of nature.

IV. Ant Community (most common insect on student plots)
  A. Generalizations
    1. An ant community is an example of nature's social communities.
    2. Although much can be learned about ants by watching them in the field, they can be studied best in an observation nest.
  B. Activities
    1. Late in the fall during the ants' mating season, collect a group of ants and eggs and place them in an "ant farm." There must be a queen and some workers (one class did not get a queen). After an interval the ants will begin to build a colony, and many of the eggs will hatch. The children can observe the definite division of labor.
    2. The students can also observe the ants' responses to stimuli, such as sugar, bread, water, tapping, etc.
  C. Evaluation
    1. The students can keep a class log of the ants' activities and responses to stimuli.
    2. From their observations of the ant farm, the students can generalize about the reasons ants live in a social community.

GOOD PLANTS TO GROW INDOORS

Plant	Start From
Philodendron	Cutting
Coleus	Cutting, seed
Narcissus	Bulb
Geranium	Cutting
Begonia (Wax)	Cutting, seed
Petunia	Seeds
Chinese Evergreen	Cutting
Ivy	Cutting
Fern	Roots and stem
Table Palm	Seed
Hyacinth	Bulb
Crocus	Bulb
Tulip	Bulb
Lily-of-the-Valley	Pips (small bulbs on roots)
Bamboo (Bambusa)	Root and stalk
Mint	Cutting, root
Chive	Bulb
Parsley	Seed
Sage	Seed
Dahlia (Minature)	Tuber

Try Planting in Water:

- Sweet Potato
- Avacodo seed
- Carrot
- Turnip
- Parsnip
- Beet

Try these others:

- Bird Seed
- Grapefruit seeds
- Orange seeds
- Peas
- Beans
- Radishes
- Corn
- Apple seeds
- Lemon seeds
- Pineapple top

(Idea from Bulla, Clyde Robert, Flowerpot Gardens)

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C. Filmstrips and 8mm Films

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Seed Dispersal. Walt Disney Productions, 1966.

Seeds and How They Travel. Encyclopedia Britannica Corporation, 1962.

Seeds Sprouting. Walt Disney Productions, 1966.

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The Pond

Specific Objectives:

1. The student can give an example for each of the following types of plants and animals in an aquatic food chain of a pond:
   a. Producer plants and animals.
   b. Consumer animals.
   c. Decomposer plants.

2. The student can predict what would happen if all the plants were removed from the pond.

3. The student can predict what would happen if all the animals were removed from the pond.

4. The student can give at least two examples of how life in the pond adapts to the changing seasons.

5. Using stick figures if necessary, the student can draw a picture showing at least one way man can help to preserve a pond community.

Activities:

1. The students can do research on the environment of the pond, life dependent on the pond, and the aquatic food chain (see attached sheets).

2. The students can take field trips to a pond (we are fortunate to have one near the school). These field trips are invaluable but require a lot of preparation with the students on how to observe.

Ongoing Activity:

The students can learn more about balance in nature by planning and setting up a classroom aquarium:

1. The teacher sets an empty aquarium in an obvious place in the classroom for a few days.

2. The students become interested in setting up an aquarium and discuss what living things could live in the aquarium, what community would these living things come from, what methods would be best for moving them to the aquarium, what other things are necessary to provide a home for these animals and plants, and what requirements are necessary to maintain a balanced aquarium (see People and Their Environment: Teachers' Curriculum Guide to Conservation Education; Science--Grades 7-8-9).

3. After doing research and taking several more trips to the pond, the students can plan and set up their aquarium.

4. The students observe changes daily and record their observations in a booklet kept by the aquarium. Each student is encouraged to contribute to the booklet, and periodically the teacher discusses the observations with the class.

5. After sufficient time has elapsed to allow the students to observe interactions in the aquarium, the teacher can relate what they have learned to the web of pond life.

Material and Equipment: (for our aquarium)

1. Aquarium
2. One pair of guppies (livebearers)
3. Two snails
4. Three water plants
5. Fine gravel
6. Thermometer
7. Light
8. Air pump
9. Water aged

The Pond

TOPICS OF INTEREST:

1. Underwater plants
2. Floating plants
3. Plants on land around a pond
4. Insects in and around a pond
5. Underwater animals
6. Any other animals found near a pond
7. Soil types in and near a pond

STUDY QUESTIONS:

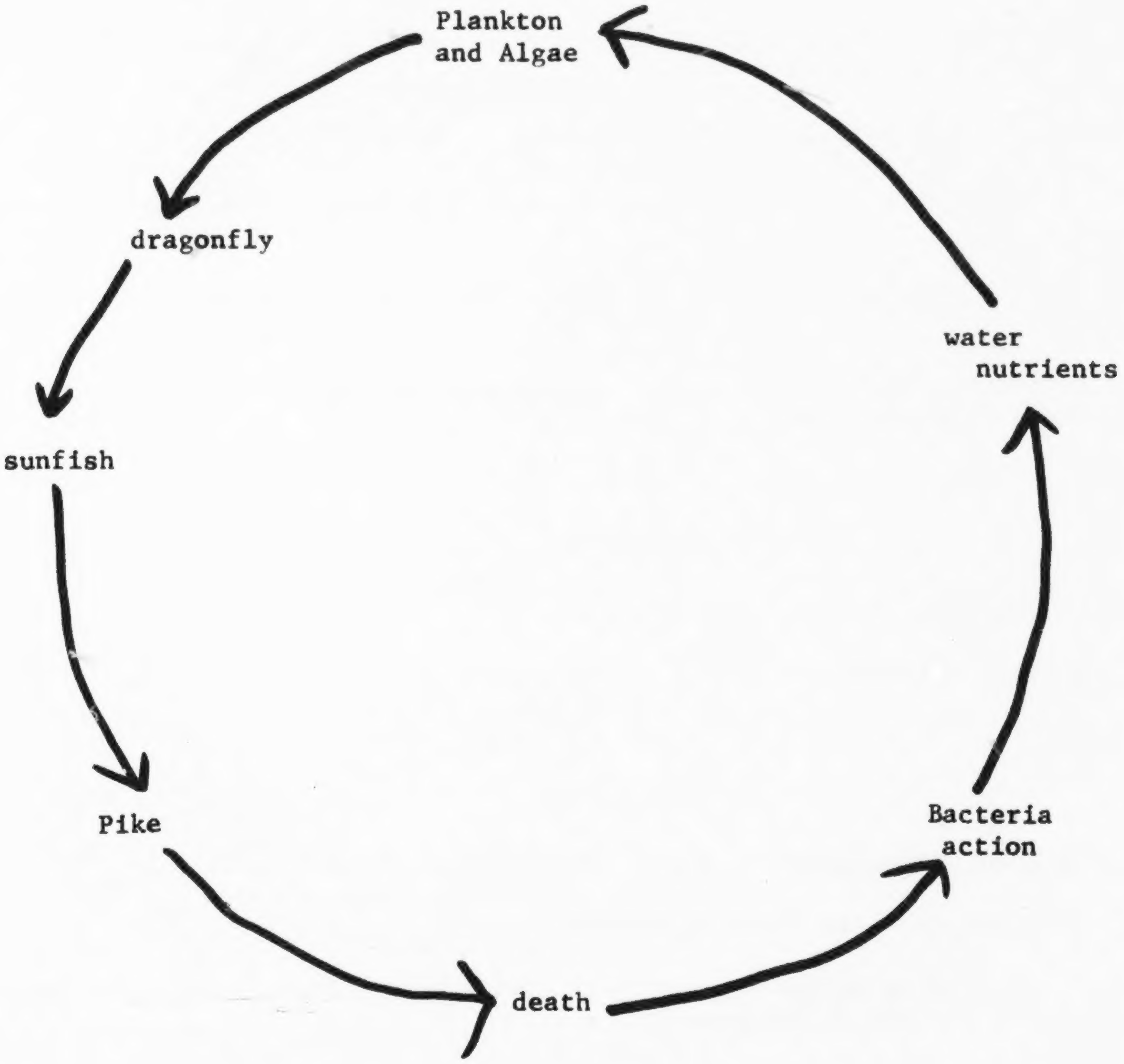
1. How do plants and animals help to change a pond?
2. How are the animals of the pond dependent on the plants of the pond?
3. How are the plants of the pond dependent on the animals of the pond?
4. Do the animals of the pond need anything outside the pond to live?
5. Do the plants of the pond need anything outside the pond to live?
6. What part does man play in helping or hindering the pond community?
7. How does the pond life adapt itself to the changing seasons?
8. Why are each of the following important to the pond?
   FIRE MAN RAIN WIND

ECOLOGY Name______________________________

Food Chain in the Pond*

In the aquatic food chain there are:

1. producer plants and animals
2. consumer animals
3. decomposer plants


Plankton and Algae
dragonfly
sunfish
Pike
death
Bacteria action
water nutrients

*Student Worksheet Explanation: In the food chain of the pond there are both producer and consumer plants and animals. Starting at any one point in the food chain one can see this relationship, e.g. the pike dies and is decomposed by bacteria action. This builds up water nutrients which affect plant life. The consumer animals will consume plants. Draw each plant or animal mentioned on the food chain to see this relationship.

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The Web of Life. McGraw-Hill, 1961.

The Marsh

Specific Objectives:

The student can answer the following in his own words:

1. How does the marsh environment differ from a pond environment?
2. Identify at least two animals and two plants that make the marsh their home.
3. Why are marshes in danger of disappearing?
4. Why are marshes important?

Activities:

1. Discuss the characteristics of a marsh with students. Discuss whether there might be an area in or near the students' own neighborhood where a marsh-like area could be studied.
2. Show film on the marsh. Have students watch film for overview of what a marsh is like. Show movie again. Have students take notes on an assigned topic of study.
3. Have students present group reports on the marsh (see attached sheet).
4. Have the class visit a marsh with a naturalist as a guide (we visited the Cherokee Marsh in Madison). After the trip have the students write up their observations in story form. Emphasize content and not length of papers or form (see attached example of student work).

Ongoing Activity:

1. Make a population study of marsh water during different seasons. Choose the volume of marsh water to study. Gather this marsh material from the same general area.

These are some of the words we have been studying in class. Write a definition in your own words and give an example for each word.

1. stable
2. variety
3. adaptation
4. competition
5. predator
6. prey
7. spawn
8. survival
9. interrelationship
10. dependence

THE MARSH COMMUNITY

meadow lark
pond
desert
meadow
mud
duck weed
trees
sand

red-winged black bird
sparrow
water lily
light
weasel
rattle snake
ferns

cattails
bob-o-link
dead animals
fungi
water
man
bugs
land

1. __________, __________, and __________ make up the floor of the marsh.

2. A marsh is both __________ and __________.

3. Because the water is __________ and __________ plants grow well on the marsh.

4. Three kinds of plants which grow in the marsh community are __________, __________, and __________.

5. Because plants and animals need each other, without the cattails for food there would be no __________. Without the cattails for shelter there would be no __________.

6. List as many predators and their prey as you can.

TO THINK ABOUT:

1. How does the marsh limit the number of plants and animals found in it?

2. What do you think "food chain" means? Give an example seen in the movie.

3. What adaptation does the heron have for catching fish?

4. Why are geese temporary members of the marsh community?

5. What is the difference between a stable community and an unstable community?

CHEROKEE MARSH

I like the way the Aspen tree leaves work. And the way the ground is spongy. I thought it would be about as big as our swamp. I never dreamed it would be so big. I didn't know that the muskrat helped the marsh so much. The muskrat helps by keeping the land where it is and not letting the land come in or after a long period of time there wouldn't be any marsh there. The muskrat eats cattails. There weren't very many cattails there an if there aren't cattails the muskrat wouldn't stay there because they eat it and use it for shelter and for their homes. The woodchucks were under a cottage for their homes. The squirrel makes a home in a hollow tree in the summer so it can have a baby and in the winter the squirrel makes its home in leaves at the top of a tree. Birds they'll chase off the other birds so they don't harm the little ones. And in the winter they go in groups or flocks. There was a glacier there at one time. There was a rock in the Cherokee Marsh that looked like a hippopotamus. There were some real pretty sea gulls there. I thought the Marsh would be as dirty as our swamp; instead it was so clean.

Mike C.
Marsh
October 23, 1969

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The Meadow

Specific Objectives:

After studying the meadow community, the students can do the following:

1. Compare what meadow plants, such as the sunflower and hawkweed, need to grow with the requirements of marsh plants, such as the cattail.
2. Give at least three reasons why the grasshopper, butterfly, meadowmouse, and meadowlark find the meadow a good place to live.
3. Predict what would happen to the animals and plants in the meadow if the rainfall fell below ten inches for several years.
4. Explain what would happen to the meadow if left undisturbed for a number of years.

Activities:

1. Classroom lecture on succession:
    a. The meadow started from an open space in which grass and flowers will grow.

    b. The wind will carry the seeds of some wildflowers to the area. These seeds will begin to grow.

    c. The wind will carry the seeds of trees, such as the elm, to the area also. If the land is still left undisturbed, these seeds will put down roots and start to grow. These trees will provide a place for birds to sit.

    d. Birds will carry in wild cherries and berries for food and will leave the seeds. As thickets develop, the grasses can not get enough sun and water and will eventually disappear.

    e. Animals which live in the thicket, such as the squirrel and rabbit, will come. The squirrel will bring in acorns and nuts for food. All these will not be eaten and some will take root and grow.

    f. As the trees develop, the thickets will disappear because they cannot live in the shade.

    g. The meadowlark, sparrow, and meadowmouse will leave too and will be replaced by the owl, jay woodpecker, raccoon, squirrel, and other forest animals.[1]
2. Visit a meadow several times to observe the plans and animals.
3. Take field trips to observe different stages in succession (we can observe several of these stages in our own neighborhood).

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[1] Elizabeth T. Billington, Understanding Ecology (New York: Frederick Warne and Co., In., 1968, pp. 53-54.

4. Invite an ecologist, wildlife specialist, or other guest to speak on succession (our speaker gave a blackboard talk).

5. Have the students give group reports on the meadow (see attached sheet).

Ongoing Activity:

Have each student draw pictures to represent the steps in succession from marsh to forest. Use a long strip of narrow white paper for each student.

THE MEADOW

TOPICS OF INTEREST:

1. Flowering plants
2. Non-flowering plants
3. Insects
4. Other animals
5. Soil types

STUDY QUESTIONS:

1. How do plants and animals help to change a meadow?
2. How are the animals of the meadow dependent on the plants of the meadow?
3. How are the plants of the meadow dependent on the animals of the meadow?
4. Do the animals of the meadow need anything outside the meadow to live?
5. Do the plants of the meadow need anything outside the meadow to live?
6. What part does man play in helping or hindering the meadow community?
7. How does the meadow life adapt itself to the changing seasons?
8. Why are each of the following important to the meadow?
   FIRE RAIN MAN WIND

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Animal and Plant Communities: Field (filmstrip). McGraw-Hill, 1961.

Grasslands: The Story of a Major Community (filmstrip from the "Basic Life Series"). Encyclopedia Britannica Corporation, n.d.

The Forest

Specific Objectives:

The student can do the following:

1. Give at least two examples of interrelationship between animals and plants in a forest.

2. Give at least two examples of forest plants and tell how they are adapted to life in the forest.

3. Give at least two examples of forest animals and tell how they are adapted to life in the forest.

4. Identify three layers of the forest and give the characteristics of each.

5. Explain in his own words at least two ways a forest community limits the number of things that can live there.

6. Suggest at least three ways man can help preserve life in the forest.

Activities:

1. Take a "treasure hunt" with students (we have a wooded area near the school). Divide the class into teams with each team having a captain and a scribe. The scribe will write down the team's findings. Stress use of all senses in observation. This activity provides an introduction for further inquiry and research. (See attached sheet.)

2. Visit the Madison Public School Forest near Verona, Wisconsin, with a naturalist as a guide.

3. View Three Layers of Green and The Madison School Forest, both produced by the Local Materials Project, Madison Public Schools.

4. Discuss identifying trees in winter. As a follow-up activity, have the class visit a woods to practice recognizing trees by their shape, bark, twigs, and buds. (The teacher used the radio program Wonderful World of Nature on "Recognizing Trees in Winter" to introduce this activity.)

5. Have the class make group reports on the forest (see attached sheet).

Ongoing Activity:

The class can visit a forest during the different seasons to observe the changes that take place. (Our classes visited the Madison School Forest in the winter to observe the tracks and trails of animals and to practice identifying trees in winter. One class even saw a weasel. Back at school the students did "cut-out art." They cut out trees and animals tracks they had seen on the trip from black construction paper and pasted them on white construction paper in a way that would "tell a story.")[2]

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[2] For the purpose of this guide we have written up each community separately; however, in the actual study we had several activities going on at one time.

Treasure Hunt

We will divide our class into teams. Each team must have a captain and a scribe. At a signal, team members scatter to find treasures, then report to their captain, who has the scribe write down the findings.

KEEP IN MIND: It is the quiet hunter who finds the most game! Noisy actions will give away clues to your discoveries.

1. One leaf from each of five different kinds of trees. (You do not need to know the names of the trees.)

2. One leaf from each of five different kinds of herbaceous plants. (Herbaceous means "without woody stems.")

3. Some evidence of where an animal, large or small, has been living, walking, or chewing. (You need not bring this back with you.)

4. Locate five different kinds of rock, or five different kinds of soil, or five different kinds of pebbles, or any combination of these. (You need not bring these back.)

5. How many plants can you find with white, yellow, pink, or purple flowers? (Do not pick any.)

6. Find a tree with very rough bark and another one with smooth bark.

7. Find a tree whose leaves and branches come out opposite each other on the stems. (Look at new twigs to find this.)

8. Find a tree whose leaves and branches come out alternately on the stem.

9. Find five plants that have not yet begun to bloom.

10. Find five plants that have gone to seed.

11. Watch for birds. How many different kinds did you see? (If you do not know their names, list them by size and color.)

12. Describe five nature sounds that you hear.

THE FOREST

TOPICS OF INTEREST:

1. Trees
2. Bushes
3. Small plants
4. Insects
5. Small animals
6. Larger animals
7. Soil types

STUDY QUESTIONS:

1. How do plants and animals help to change a forest?

2. How are the animals of the forest dependent on the plants of the forest?

3. How are the plants of the forest dependent on the animals of the forest?

4. Do the animals of the forest need anything outside the forest to live?

5. Do the plants of the forest need anything outside the forest to live?

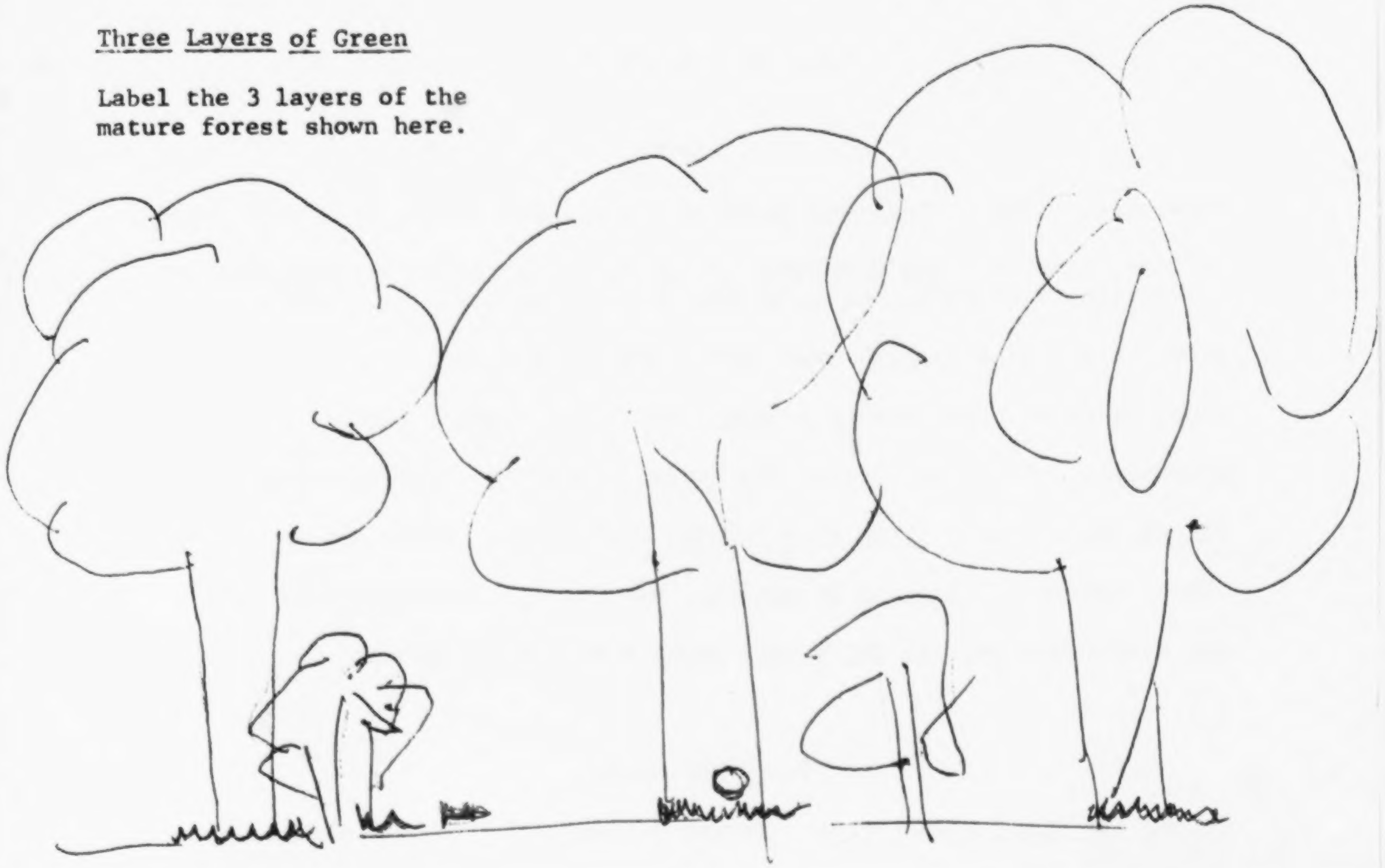
6. What part does man play in helping or hindering the forest community?

7. How does the forest life adapt itself to the changing seasons?

8. Why are each of the following important to the forest?
   FIRE RAIN MAN WIND

Three Layers of Green

Label the 3 layers of the
mature forest shown here.



List some plants and animals likely to be found in each forest layer.

1. Canopy . . . .

. . . .

. . . .

2. Understory . . . .

. . . .

. . . .

3. Ground Cover . . . .

. . . .

. . . .

(Idea from Science In Action Workbook, p. 1)

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Three Layers of Green (filmstrips). Produced by the Local Materials Project, Madison Public Schools, and distributed by Visual Educational Consultants.

POLLUTION

Objectives

1. To name three main kinds of pollution and define each.
2. To cite examples in Madison of each kind of pollution.
3. To keep a list of possible solutions (at all levels, including personal) for pollution.
4. To discuss at the end of the unit all kinds of pollution studied--their causes, effects, and possible solutions.

Activities

1. Film and tape on pollution in Madison.
2. Song from Hair about air pollution.
3. Cartoons (casue-effect-solution) on pollution.
4. Articles on pollution from newspapers and magazines.
5. Reports and presentations of some of the new articles.
6. Letters to Governor Knowles, Clifford Hardin (Secretary of Agriculture), Senator Proxmire, Senator Nelson, Mayor Dyke, and Alderman Hall (Alderman for the school neighborhood) as a "protest" to pollution.
7. E-Day activities connected with pollution.

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4. Lewis, Alfred, Clean the Air!, McGraw-Hill, 1965.

5. Film and tape--produced by Mr. Chris Ramig, Marquette Junior High School. (All filming and taping done by students.)

6. Record album Hair--song about Air Pollution.

7. Daily newspapers and magazines.

E-Day

Objectives

1. To further increase awareness of ecology and the world in which the student lives through participation in Earth-Day activities.

2. To actively involve parents and other grade levels in whole aspect of ecology.

3. To emphasize the united cooperative effect of E-Day activities; to coordinate with other community and national actions such as National Teach-in; to talk about our wrecked earth, parades, demonstrations, etc.

4. To allow children to explore the problems presented by E-Day and be prepared to "demonstrate" on this day by making models and explaining them, writing a play and presenting it, advertising about E-Day and setting up guided tours, and researching predefined areas for a panel presentation on E-Day.

Activities

1. Texas Beavers--panel presentations.

2. Busy Bees--projects and models, pollution song.

3. Hoot's Hooters--projects and models, choral reading.

4. Playful Cubs--script writing and presentation of play.

5. Alvin's Advertisers--badges, advertising fliers, newspaper, guides for tours on E-Day.

TEACHER SKIT

(to introduce E-Day Groups)

Each animal walks in looking and commenting about the following: beaver--wood; chipmunk--nuts; bear--honey; bee--flowers. Owl is already sitting in tree.

BEAVER: Wood is so scarce, it makes me sick!
I'll have to file my teeth and build a house of brick.

Alvin! Alvin! ALVIN! (Louder each time.)

(Alvin enters.)

ALVIN: O.K.

BEAVER: (Repeats his couplet to the chipmunk, Alvin.)

CHIPMUNK: I've found it! I've found it! Quick, let me see;
Oh...a half-eaten nutshell left for me.

(Pooh Bear enters and Alvin repeats to Bear.)

BEAR: I've sniffed and sniffed for something yummy;
A big jar of honey would fill my tummy.

(Busy Bee enters and Pooh Bear repeats to Bee.)

BEE: These flowers are faded and don't smell sweet;
I refuse to gather pollen with my clean feet.

(Repeat.)

EVERYONE: What can we do? What can we do?

OWL: Besides boo-hoo; besides boo-hoo.

EVERYONE: Oh, wise owl, please help us.

OWL: Let me look it up in my book. (Animals worry and think.)

BEAVER: I've got it! I'll go to Washington and talk with the President.

(All animals except Owl cheer, pat Beaver on the back, and say words of congratulation, such as "That's the answer, Beav!)

OWL: The President has been looking for a fine beaver skin
hat made from a silky coat like yours.

(Beaver begins to cry, and others comfort him.)

CHIPMUNK: Then I've got it! I'll go see our city mayor!

OWL: He doesn't want to see anymore nuts like you.

BEAR: Well! The governor would welcome a fine bear like me in
his office!

OWL: He would also welcome a soft bearskin rug on cold mornings.

BEE: I'll fly all the way to see a senator!

OWL: It would be a long way to buzz, honey!

BEE: I guess people are too big and don't care about their
little friends like us.

OWL: Why don't you start your own campaign?

OTHER ANIMALS: Champagne? Did Owl say champagne?
Oh boy! I've heard that's go - od!

OWL: Let me look in my book...NO! NO! Campaign...
start your own campaign.

OTHER ANIMALS: What's a campaign?
What's a campaign?

ALVIN: It means we work together--all of us--and do something.

EVERYONE: (March among audience and sing the following to the music
of "When the Saints Go Marching In.")

Oh when the smog comes rolling in,
Oh when the smog comes rolling in;
I don't want to be in that number
Oh when the smog comes rolling in.

Oh when the trash retains its smell,
Oh when the trash retains its smell:
I don't want to be in that number
When the trash retains its smell.

Oh when the flowers all fail to bloom.
Oh when the flowers all fail to bloom;
I don't want to be in that number
Oh when the flowers all fail to bloom.

(Gradually slow down.)

Oh when the woods are all destroyed,
Oh when the woods are all destroyed;
I don't want to be in that number
Oh when the woods are all destroyed.

(Animals cry.)

ALVIN: I'm going to direct the next verse.

BEAVER: ALVIN!

ALVIN: I am!

ALL ANIMALS: (Singing again)
Oh when the students begin to care,
Oh when the students begin to care;
I do want to be in that number
Oh when the students begin to care.

(Repeat and students join in.)

EXIT

(Teachers re-enter with signs advertising their activity groups. Each teacher explains his group; then the students return to their classrooms to choose groups.)

TEXAS BEAVERS' TALK-IN

Objectives

The students can do the following:

1. Recognize the complex nature of pollution problems.
2. Detect oversimplification in many proposed solutions to pollution.
3. Identify some of the different viewpoints and problems of industry, government, and other segments of our society concerning pollution.
4. Present these different viewpoints to others, utilizing facts and examples.

Activities

1. Have students bring articles on ecology and pollution for daily discussion. Set up rules of procedure for these discussion, e.g., rising to be recognized. The rules we chose were based on rules followed later during formal panel discussions.
2. Divide the group into committees for research on ecology and pollution. (Our division of study for these committees were based on the viewpoints that could be held by people working in the following areas: industry, business, government, and home.) In the daily discussions have the students speak as people from these various groups might respond. (Research includes telephone interviews, personal interviews, surveys, etc., with adults involved in each area of study.)
3. Have students choose panel members and chairman. The other students respond from the floor.
4. Gather questions from prospective audience in advance if possible. We categorized the questions received into five general areas:
    - (a) What is ecology?
    - (b) Why have an E-Day?
    - (c) Why is pollution such a problem?
    - (d) How do different groups of our society respond to pollution problems?
    - (e) What is being done about pollution?

5. Have students assume roles when they present their talk-in. (For example, there might be ecologists, industrialists, drillers, senators, aldermen, grocers. housewives, etc.)

Bibliography

Kitzinger, Angela. Air and Water Pollution. Chicago: Lyons and Carnahan, 1966.
This is a good general reference.

(Eash student was responsible for documenting his own comments.)

BUSY BEES

Objectives

To prepare a chart, project, model, or demonstration and:

1. Explain purpose (why it was made).
2. Explain cause of problem shown.
3. Explain possible solutions to problem.
4. Explain steps to take in prevention of like problems in the future.

Activities

1. Balance of Nature
    a. Flannel board story (see bibliography)
    b. Food chains and cycles--3-D diagrams
    c. Effects of pesticides--dioramas.
2. Conservation

    Fire tower to show proper care of the forest in order to keep it free and in its natural state.
3. Living Habits (Personal habits that add to pollution)
    a. Buying habits--don't buy: Non-returnable bottles, detergents with high phosphate counts, multi-wrapped packages, paper products, "throw-away" articles. (Examples brought in, listed, displayed, written about through poetry.)
    b. Items made from otherwise useless articles--child's playroom of toys: building blocks, hobby horse from boxes and tin cans, trucks, pull-toys from round cartons. Vase of flowers--vase from throw-away glass container, flowers from discarded paper. Mosiac--broken bottles of different colors.
    c. Examples of re-using articles: plastic bread wrappers for freezing, return or re-use grocery bags.

4. Pollution

   a. Cars--modern day "pollution machines" and possible non-pollution models--charts, drawings, and models.

   b. Industry--factory showing several kinds of pollution--litter, water, and air (including a working model of air pollution by blowing powder through the smoke stack.)

   c. Noise--tape recording of noise pollution explaining decibels and possibility of deafness from certain sounds (at a low volume).

   d. General pollution--land and water...

      small globe with paper scraps glued over it

      dishes of clean water and polluted water on bed of sand

      clay model of beach strewn with litter and dead fish

      "past" model showing clean lands and animals in abundance and "present" model shown as a junk yard

      song--Pollution from album Hair.

Bibliography

1. Treat, Dorothy, "The Good Word BON:, Audubon Nature Bulletin, Series No. 24, Bulletin No. 1., New York: National Audubon Society, 1955.

2. Pamphlets and mimeographed sheets from state and national agencies.

3. "Pollution" from record album Hair.

HOOT'S HOOTERS

Objectives

1. When presenting the choral reading, child will be emphatic and "talk to the audience," expressing the problem of mounting pollution.
2. In display form child will state a pollution problem as he sees it; when questioned by the teacher, child will show evidence of the problem existing.
3. Child will demonstrate alternative solution to the problem.
4. Child can explain and answer questions about project when approached by visitors on E-Day.

Activities

1. Choral reading--poem, "I Am Waiting" by Ferlinghetti, revised to express problem of mounting pollution (group of 24 pupils.
2. Individual projects--plastic bags, oil drilling off the coast, cars, recreational use of our lakes and streams, cycles showing the balance of nature, how a body of water becomes polluted.

Bibliography

1. Brennen, Matthew J., Teachers' Curriculum Guide to Conservation Education, Grades 4-5-6, G. Fergunson Publishing Company, Chicago, 1968, pp. 32-35, 41-46, 63-67, 72-73.
2. Ferlinghetti, Lawrence, A Coney Island of The Mind, New Direction Publishing Corporation, New York, 1958, pp. 49-51.
3. Kitsinger, Angela, Dimensions In Health, Unit text: Air and Water Pollution, Lyons and Carnaham, Chicago, 1966.
4. Film: Pollution, Cause and Control, Department of Natural Resources.

PLAYFUL CUBS

Objectives

1. To learn history of pollution by re-examining the U.S. history books for signs of abuse of our land by our forefathers and mothers.
2. To then choose six historical events and write script showing how each event contributed to the abuse of Mother Earth.

Activities

1. Columbus and the discovery of America

   Emphatically described the land in its pristine beauty to contrast with the other scenes.

2. Pilgrims

   Cut down trees indiscriminately; cleared land; forced animals to find other homes.

3. Boston Tea Party

   Dumped tea into the Bay--a clear case of pollution.

4. Pioneers

   Threw out possessions in an effort to make wagons lighter.

5. Civil War

   Butchered the terrain; made toothpicks out of whole forests of trees.

6. The modern dragster

   Souped-up modern car adds CO_2 to the atmosphere among other abuses.

The various scenes were connected by two inquisitive boys who pushed buttons on a computer which controlled the "Tunnel of Time". As the boys fooled around with the buttons, out came the various actors.

The message this young group tried hard to get across was that the destruction of our land has been going on for a long time, that we of the present are not to be blamed entirely, but that we will do our best not to allow such things to continue!

Materials

1. A 4 x 12 ft. mural (chalk) was made depicting something appropriate for each scene.
2. A large washer or dryer-type box was painted and used with lighting effects as a computer.
3. A very large freezer-type box was covered with paper to assimulate cave effects and was used for the "Time Tunnel".
4. Other props needed by each group were also made: costumes, signs, cardboard boulders, a dragsters car (also cardboard).
5. An attempt to use the tape recorder for sound effects was also made.

ALVIN'S ADVERTISERS

Objectives

1. To realize the importance of advertising.

2. To be able to work together as a group--many ideas coming together.

3. To realize the importance of sharing information that is learned.

4. To realize the importance of each individual's role in his community--the effect one can have on peers and parents.

Activities

1. Badges--cardboard squares were paper mache, painted, and shellaced with our original design for E-Day. Each 5th grader received a badge to wear on E-Day.

2. Sandwich signs--two large sheets of cardboard were worn by one person--front and back. We used this as a means for advertising E-Day, April 22 (slogans and large pictures).

3. Flyers--in order to advertise through-out our school, we sent out flyers appropriate for each grade level. These were activity flyers such as bookmarks for the students to cut and color.

4. Newspaper-articles, cartoons, and interviews made up the issue contents. This was distributed to each grade level.

5. Awards program--an awards program was set up to be presented on E-Day morning. All who participated in each group were given badges for doing an outstanding job. A skit was also presented that corresponded to the teacher skit presented at the beginning of the E-Day activities.

"DEAR HUMANS"

Simon: "It's 10:00 o'clock! Where is everybody? The meeting starts at 10:00 o'clock! Where's Alvin?"

(starts calling softly - Alvin - ALVIN!!!)

Alvin: O.K. O.K.

Simon: "I've called this meeting for a very important purpose. We need to see if those humans have really done anything about our problems. Where could all the forest folks be?

Alvin: Mr. Bear!

Bear: (groans heard from hall)
"I've eaten too much - 6 buckets of honey.
I love that bee; she filled my tummy".

Bee: (comes in sleepily buzzing - ho humming)
"Smell these flowers, aren't they sweet?
I've been gathering pollen with my clean feet".

"Those humans quit spraying - they must care;
That makes two of us happy - a bee and a bear".

Bear: (ouch)
"Boy, I've been busy; my teeth are sore.
I've built 3 homes and my friends want more".

"Thanks to the humans the forests have bloomed;
They've picked up my spirits and got rid of my gloom".

Alvin: (me, too!)
"The nuts are all over - hundreds to see...
No half-eaten nutshells are left for me".

Owl: (front tree)
"I see you've all learned that humans aren't all bad,
They've made you happy instead of sad".

"Now what can you do to thank one and all?
The humans have saved you from a great fall!"

Simon: H is for humans, you're not so bad!
Alvin: U is for understanding, you all have had.

Bear: M is for mending your very bad ways,
Bee: A is for awards you'll receive this day.

Beaver: N is for acting "NOW" which you have earned.
Owl: S is for sharing all that you've learned.

(Animals go out and re-enter holding signs representing each group.)

END

SAVE MY PLACE

An ecology slide set narrated by students
and presented at a P.T.A. meeting, May 4,
1970

I. TEACHER PLANNING

1.	Title: Save My Place	"Save my place for me Don't mess up my world for me I want my place saved." by Darcy Swan
2.	Title Slide: Teacher Planning	
3.	Title: Newspaper	Everybody is hearing and talking about ecology today, but just what does it mean? It is the relation of living things to each other and to their environment. Ecology is a total "care" package filled with concern...but also hope.
4.	Title: Picture of School	The fourth and fifth grade students at Elvehjem School are familiar with this definition, but just how did our ecology program at Elvehjem get started?
5.	Title: Pioneer Group DeVoe Richard Hedine Ramig Wunderlich Gross	In the spring of last year an energetic group of teachers applied for a federal grant. They felt that the availability of a pond and woods in the neighborhood would enhance their chances of receiving the grant.
6.	Title: Mr. Howard & Miss Gross with giant letter	June 4th! O Happy Day! We got it! We got it!

TEACHER PLANNING - cont.

7.	Group Picture	September 9th! Top row: Are you ready? Mrs. Ramig, Mr. Howard, Mr. Dalton, Mrs. Studee, Miss Gross, and Mrs. VanderVelde? Second row: Are you ready? Miss Wunderlich, Mrs. Devoe, Miss Hedine, Mrs. Calabresa, and Mrs. Richard?
8.	Teacher with foot in bucket	You new teachers are going to have to get your feet wet!
9.	Miss Gross asleep	"Miss Gross? This is Mrs. Studee. There are four more cartons of new materials in the office for you. Miss Gross...Miss Gross?
10.	Teachers planning	No time for more than a wink, however! We were busy! Planning concepts, objectives, and activities from the ground up! (Student paper: "The Four Concepts")

II. THE POND

11.	Title Slide	"Waterweeds Duckweeds Plants live beneath the water, And some plants float on top." by Paula Klump
12.	Distant view of pond	The public is aware that nature is more than an animal here--a plant there! Now we see nature as air, sun, water, soil, plants, and animals all related in a delicate balance. This relationship in the pond area is what the students remember, and they would like to see this balance preserved.

THE POND - cont.

13.	Close-up view of pond area	The plants of the pond area are important to this natural balance. The green floating plants in the upper layers of the pond are the aquatic food factory, carrying on the basic process of photosynthesis. The rooted plants in and around the pond provide among other things shelter for some aquatic animals and places where many animals lay their eggs.
14.	Girls and pond area	A few swoops of the net in the area around the pond will isolate a fascinating world of little creatures for observation.
15.	Boys and pond area	These students are studying arthropoda, a phylum in the animal kingdom which includes insects. They are aware that man tends to label most insects as pests.
16.	Boy about to fall	Of course, the excitement of discovery can be almost too much! Some of us came back with wet feet. (Student paper: "Inter-relationships")

III. THE MARSH

17.	Title slide	"Down by the forest Down in the marshy old marsh Is ecology." by Crit Waller
18.	Grasses and marsh	Our next area of study was the Marsh. At first sight a marsh may seem to be a very lonely place: quiet water and tall grasses. However, we found it full of life of many kinds, especially bird life.
19.	aerial view of marsh	The Cherokee Marsh in Madison gave us the opportunity for a field trip to view marsh inhabitants and their activities.

THE MARSH - cont.

20.	Children in marsh	We found that cat-tails, eel grass, saw grass, musk grass, and duckweed serve as food and shelter for the inhabitants.
21.	shore view	A marsh is a place of shallow waters, and muddy bottoms thick with decayed vegetation.
22.	Weeds around marsh	Mounds of soft ooze rise here and there, sometimes surrounded by small stagnant pools.
23.	Marsh and forest	The land surrounding the marsh begins to rise and harden. Here we can see small trees taking root, the result being natural succession.
24.	Diagram: Succession	Over a period of many years, plants and animals in the water die and fall to the bottom, gradually adding layer upon layer to land build-up. In this way land rises, and eventually, even forest may develop here.

IV. THE FOREST

25.	Title slide	"Trees, what have you seen? Tell me what you saw years ago. If only you could talk." by Susan Leeman
26.	Children entering school forest	Let's take a stroll through a forest as our Elvehjem pupils did many times this year. We think you'll find there's more to it than first meets the eye.
27.	Forest path	This quiet, shadowed path led us into a world of many living things. We found that the forest is characterized by three layers of natural vegetation--three layers of green--ground plants, low shrubbery, and tree foliage.

28.	Squirrel in tree	Each layer has it's own inhabitants peculiarly suited by nature and adaptation to live most successfully on its own "home ground." (Student paper: "Adaptation")
29.	Black Oak and White Oak	Two important residents in the transitional oak forest are the black oak on the left and its lighter barked cousin, the white oak, on the right. Other oaks too may be found. These forest grown trees saved their branch growth for the tops to gain better sunlight.
30.	Open grown Oak	Field trips are fun and useful at any time in the forest. Here we gather around to talk about some things we have observed.
31.	Students in two groups	Winter residents of the forest must work a little harder to find their food. Only the strong survive. They chew the bark from shrubs and saplings,
32.	Students looking for tracks	and in their search leave many tracks.
33.	Teacher on railing in forest	Snowtime is quiet time in the forest. Time seems to stand still and sound is muffled by a soft blanket of white. Isn't this a peaceful scene?
34.	Girl in red coat looking at deadfall	Natural deadfall is an important part of forest growth and development. Such deadfall should be allowed to remain undisturbed to return natural to the natural scheme of things.
35.	Winter tree with snow on bark	Everywhere we look we see something new and beautiful: a pattern of snow on the black oak bark;

THE FOREST - cont.

36.	Boys digging in snow	a pattern of green waiting under the snow for spring;
37.	Bracket Fungus	or perhaps only the bracket fungi in a variety of colors,
38.	Stump with Fungi	quietly returning the dead wood to the soil.
39.	Young Aspen in bud	And as always, spring returns to the forest, dressing the young aspens in a delicate green. Young leaves bud, wildflowers nod in the cool air and a new season of activity and study comes to the quiet woods.
40.	Aerial view of Elvehjem area	Many of the preceeding forest pictures were taken in the Madison School Forest, south of Verona, but as you can see, we could easily duplicate many of them in the little forests we have in our own community. If we can maintain our own woods in their natural state, all this is on our doorstep.

V. FOOD CHAINS

41.	Food Chains	"Food chains Keep in order. Try not to mess things up. Leave them alone, cause they'll take care... Food chains." by Ellen Gilbertson
42.	Diagram of a simple food chain	An example of the balance in nature is the food chain. Some animals, such as rabbits, eat plants. These animals are called primary consumers or herbivores. They in turn are food for secondary consumers or carnivores.

FOOD CHAINS - cont.

43.	Teacher and student paper food chain	Many of us did research and then constructed simple food chains with each picture shaped like a link in a chain.
44.	Students and paper food chain	Next we experimented with linking the simple food chains together. It didn't take us long to discover just how interrelated the interrelationships in nature are! (Student paper: "Diversity")

VI. CHEMISTRY

45.	"Chemistry"	Test tubes and hot plates Microscopes and air bubbles Chemistry is fun! by Lynn Johnson
46.	Chemistry is fun Pupil by bulletin board	During the year fundamentals of chemistry were studied to give some basic understanding of the nature of matter, leading to a better understanding of how plants produce food by photosynthesis.
47.	2 students taking things off bulletin board	Luckily, some of the bulletin board displays of atoms and molecules were edible themselves, adding to the fun of studying chemistry.
48.	Calabresa & Dalton	These pupil prepared bulletin boards described how atoms and molecules are arranged in familiar compounds and elements.
49.	Students and own microscope	Some of the students used simple microscopes to help in the study of chemistry and other units. Some of them even worked!

CHEMISTRY - cont.

50.	Boy with microscope	Down the barrel of the microscope exists another world filled with wonder and design and many things to study and watch. (Student paper: "Constant Change")

VII. STUDENT ACTIVITIES

51	Title Slide	"Projects, plays, stories Everybody has some fun What a way to learn! by Jim Zantow
52.	Loading bus	Does everyone have his animal track guide? Let's load the bus and see what we can find at the School Forest after a fresh snowfall!
53.	Research	Now let's do a little research on some of those animal tracks.
54.	Student in IMC	Look what I found about the weasel!
55.	Students in RMC	Our resource center also is filled with a variety of materials on ecology--filmstrips, wall maps, charts, and books.
56.	Students Browsing	Mike and Shawn are browsing through some of the new material.
57.	Girls and Gerbils	However, we learned in other ways too. Sharon and Sheryl enjoyed having pet gerbils in their fourth grade classroom.
58.	Poster	Field trips to the School Forest were a highlight of our program. Here Sharon, Susan, and Laurie enjoy snapshots taken.

STUDENT ACTIVITIES - cont.

59.	Poster	Look at these pictures! Gloria seems to have spotted familiar people and places.
60.	Pollution posters	Pollution has been the issue this spring everywhere. Gayle is pointing out interesting articles brought in by the students in her class.
61.	Amy and Debbie	Why such big smiles, Amy and Debbie? You say you each own $10.00 in the quality environment contest? Congratulations!
62.	Play cast	Here is Amy's original Broadway cast for her prize-winning play, "Clean Town".
63.	Prof. Ellarson	The professionals even came to Elvehjem. Professor Ellarson, known for his "Wonderful World of Nature: radio program, spoke to us about plant succession.
64.	Teachers	Now presenting another great acting company - the fifth grade teachers and our fantastic librarian! Representing the animals of the forest in a skit are Pooh Bear, Alvin Chipmunk, Busy Bee, Texas Beaver, and Hoot Owl.
65.	Teachers	The forest animals are sad - their environment has been tampered with!
66.	Teachers	Such great talent! We couldn't wait to choose a group in preparation for E Day, April 22nd.
67.	Guides	The big day has arrived! E Day! So much to see! Alvin's advertisers guided our observers from room to room.
68.	Project area	First we toured the project area.
69.	Project area	Here two groups have gathered around interesting projects.

STUDENT ACTIVITIES - cont.

70.	Projects	Explanations and demonstrations of projects were given by the students.
71.	Indians	Next our guides take us to Pooh Bear's group, who called themselves the Playful Cubs. The Indian's answer to the pollution problem was, "We didn't do it, but where is that Columbus?"
72.	Play - generals	Our Civil War generals, Tim and Jerry, had to admit to the careless destruction of our land.
73.	Panel	Next we move to our panel discussion with the Texas Beavers. Gayle is giving us an introducti to the pollution problem.
74.	Panel	Then not only panel participation but a few irate audience members! Time to pound the gavel, Kathy!
75.	Boy at window	I know that we depend on nature and that nature depends on us. Do you care? I know that animal and plants work together for good. Do you care?
76.	Tree against sky	I know a world of wonderful design, With flowers spreading their faces to the sun And wind rustling the leaves of my favorite tree I enjoy the squirrels hustling to and fro, And birds calling me up in the morning with song. I know a world of wonderful design, But the future belongs to those who care.

(Cue Slide: "Teacher Planning-Boy about to fall")

THE FOUR CONCEPTS

I am Lori Soehle. In science this year we have studied four big ideas: diversity, change, interrelationship and adaptation. We tried to figure out how these four big themes fit in with the subjects we studied. These subjects were: insects, rocks, matter, air, water and forest. The first subject we studied was insects. We found that insects changed from a larva, to a pupa, to an adult. Insects differed too. This showed us diversity. Some insects ate plants; this showed us the interrelationship of living things. We found that the insects adapted to their surroundings; the insects just fit in where they lived.

The next subject we studied was rocks. We found that rocks were changed by heat, pressure, and water. Some rocks differed; this showed diversity. Some rocks differed in color, some in size, some the way they were formed. The rocks adapted to the place they were too. When rocks blended in with the soil cycle this showed interrelationship.

The next subject was on matter, we found the changes in this were physical and chemical changes. Matter we found is a substance that takes up space. When something was done to a solid, liquid or gas, it changed its state.

The next subject was air. Air is different; it all depends on where it is found--this showed diversity. Air can be compressed; this showed adaptation and change. The carbon dioxide cycle showed interrelationship (we breathe out carbon dioxide; plants give off oxygen).

The next subject we studied was water. We found it had a cycle. Water is in different amounts in different places. Water is very important to us.

The next subject was the forest. In the forest there are many animals and plants. They are interrelated. This shows interrelationship. They adapt to where they live. They live in different places. They depend on each other.

I hope you will enjoy hearing more about our studies as we continue with our program. We fourth grade students will explain in more detail what we have learned about the four major concepts as the program progresses. We wrote our own explanations.

Thank you.

(Cue Slide: "Pond: Boy about to Fall")

INTERRELATIONSHIP

My name is Jeff Parsons. I am discussing the sun and how it relates to living and nonliving things. The sun, as was mentioned earlier, is a very important part of nature. If the sun disappeared, it would be a great hazard, because the sun gives us warmth, light and energy. We wouldn't have plants and water; we would freeze. The sun's energy helps to distribute water to all living things by evaporating the water. The water turns into clouds and falls as rain. The heat energy from the sun will help the plants and animals to decay, forming humus. The sun's energy helps the plants grow.

You heard the word photosynthesis mentioned as we told you about the pond area. The word photosynthesis means "putting together with light". It is the process by which green plants manufacture food. Animals, including man, get their energy directly or indirectly from plants. For example, energy gets to an unborn colt from its mother when she eats oats, hay, and grass.

Plants and animals also relate to the sun in other ways. Plants and animals learn to live with different amounts of sunlight. Desert plants have thick skins to protect them from the hot sun. Most desert animals hunt at night because it's too hot in the day.

These are a few examples of the millions of ways plants and animals learn to live with the amount of sun they receive.

(Cue Slide: "Forest: Squirrel in Tree")

ADAPTATION

My name is Keith Ballweg. My report will explain other ways plants and animals adapt to their environment or habitat. For instance, in a deciduous forest like the School Forest, the fox adapts to his environment by eating squirrels, fish, weasels, frogs, and raccoons. The deciduous forest has different kinds of birds like the woodpecker; it adapts to its environment with its beak. Its beak helps it to get insects underneath the bark of the tree; it also helps it to build its home in the tree.

Wild flowers bloom in the spring because they need the sun in the forest. If they bloom in the summer, there would be a leaf canopy over them, and they couldn't live. That's their adaptation. This goes on and on into the future; it's a never ending cycle in the balance of nature.

(Cue Slide: "Food Chain: Students and Our Paper Food Chains")

DIVERSITY

We have interrelationships because we have diversity. If we didn't have diversity, some of the animals might die because the animals or plants that they depend on might not be there. For example, if there were trees that didn't produce nuts, the squirrel might die because it didn't have any nuts to eat. On the other hand, if there were no squirrels, many new trees might not grow. Squirrels do not eat all the nuts they find. Some uneaten nuts are carried around; then either dropped or hidden by squirrels in places where new trees can grow. So diversity is needed because plants and animals depend on each other.

There is diversity in biomes also. If our world were just desert, some of us (animals, plants, etc.) would die because some animals and plants need forests to live in; others need swampy places to live in. Without different places to live these animals and plants might die and become extinct. But some animals and plants might adapt to the desert area. It also wouldn't be good if it were all forest. If it were all forest, other animals and plants would die because they might need to live in the desert instead...or swampy places. Without their homes they might die out too. Because there are so many diverse kinds of plants and animals, we find things living in all parts of the world.

(Cue Slide: "Chemistry: Boy with Microscope")

CONSTANT CHANGE

My Name is Mark Feltshog. One of the things we learned as we studied chemistry and other subjects was that change is constant in nature. Some changes we can observe rather easily; others can not be seen so readily. For instance, some scientists believe that all rocks are igneous in origin. If this theory is true, one or two things can happen to an igneous rock. It can be weathered to form sediment and soil. Then pressure can be added to make sedimentary rock, such as sandstone. On the other hand, the same igneous rock plus heat and pressure could produce a metamorphic rock. These processes take many years. Our natural resources, such as oil and coal, also took many years to form. Another example of long-term change is succession. An undisturbed piece of land, given time, will become a grassland. Eventually, a few shrubs will appear until they control the grass land. The next step in succession is the young forest; this will eventually become a mature forest.

Short-term changes, however, are more easily noticeable and include such things as the water cycle and life cycle. The basic changes noticeable in the water cycle start with evaporation and continue through condensation and precipitation. The life cycle can be exemplified by the life cycle of the turtle. The turtle egg is incubated in the sun; then the baby turtle hatches out and crawls toward a body of water. There he eventually becomes food for another animal or returns to the earth as nutrients when he dies. Matter and energy can not be created or destroyed; but one can be changed into the other.